

March 4, 1957

50 cents

EXCLUSIVE REPORT:

# AVIATION WEEK

A MCGRAW-HILL  
PUBLICATION

## Infrared Revival Challenges Radar

•  
Infrared Maps Manhattan



where access is limited...



**KAYLOCK®**

all-metal self-locking nuts

## INTERNAL or EXTERNAL WRENCHING HEX NUTS



Tensile nut strength with clear nut height—the lightest of all self-locking nuts.

**LIGHT WEIGHT • FULL STRENGTH • LOW HEIGHT**

Another Kaylock first—the new KAYLOCK HEX NUT provides a substantial reduction in wrench clearances required for installation of AN365, AN364 and AN363 self-locking nuts. (Center hole diameter, spot face diameter and edge distances may be greatly reduced.)

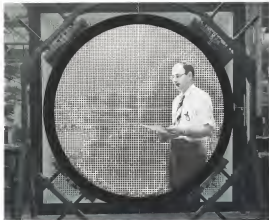
This new Kaylock hex nut is approved for all three Air Force-Navy standards: AN363, AN364 and AN365. For more information, write for our catalog.



THE KAYMAR COMPANY • KAYLOCK DIVISION, Dept. AR, Box 22001, TERMINAL ANNEX • LOS ANGELES 54, CALIFORNIA

Canada Distributors: Alcanex Aero Ltd. Montreal

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## In the circle:

Fidelity by the foremost in Stretched Plastics

In the circle above, you see an engineer standing between a sheet of stretched plastic and a grid board which checks the optical perfection of the material.

Conveying proof in a field in which Goodyear Aircraft Corporation has no peer.

As first to stretch-form a full-size aircraft canopy, Goodyear Aircraft engineering established the criteria for progress in this important field—pioneered two unique fabricating processes which (a) save weight, (b) solve long-standing problems of shattering and cracking in plastic windows and cockpit enclosures.

This experience and these processes can serve you well—just as they are serving production orders and orders for prototypes for such planes as the F-300A, F-101B, F-102B, F-106A, F4H and 707.

The closer in years, depending upon the stringent to form, the detail and complexity of your canopy one.

Approximate: the Goodyear Aircraft Stretch Form Process which first stretches the plastic as shown above, then forms it—or the Memobond Process which simultaneously stretches and forms plastic in a single operation.

But whatever the process—call us Goodyear Aircraft and be assured of fidelity of fabrication by the foremost in stretched plastics! For engineering consultation, write: Goodyear Aircraft Corporation, Dept. 903AC, Akron 15, Ohio.

*They're doing big things at*

**GOODYEAR**  
**AIRCRAFT**

*Plastics in Akron, Ohio, and Lockheed Park, Atlanta*  
*Research Centers for Engineers*

Illustration: Courtesy of Goodyear Aircraft Corporation, Akron 15, Ohio

Figure 1 displays 20 numbered line drawings of various mechanical lifting devices, arranged in a grid. The devices include:

- 1. A crane with a long horizontal jib and a counterweight.
- 2. A crane with a vertical mast and a horizontal jib.
- 3. A crane with a vertical mast and a horizontal jib, similar to 2 but with a different counterweight arrangement.
- 4. A crane with a vertical mast and a horizontal jib, similar to 2 but with a different counterweight arrangement.
- 5. A crane with a vertical mast and a horizontal jib, similar to 2 but with a different counterweight arrangement.
- 6. A crane with a vertical mast and a horizontal jib, similar to 2 but with a different counterweight arrangement.
- 7. A crane with a vertical mast and a horizontal jib, similar to 2 but with a different counterweight arrangement.
- 8. A crane with a vertical mast and a horizontal jib, similar to 2 but with a different counterweight arrangement.
- 9. A crane with a vertical mast and a horizontal jib, similar to 2 but with a different counterweight arrangement.
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- 16. A crane with a vertical mast and a horizontal jib, similar to 2 but with a different counterweight arrangement.
- 17. A crane with a vertical mast and a horizontal jib, similar to 2 but with a different counterweight arrangement.
- 18. A crane with a vertical mast and a horizontal jib, similar to 2 but with a different counterweight arrangement.
- 19. A crane with a vertical mast and a horizontal jib, similar to 2 but with a different counterweight arrangement.
- 20. A crane with a vertical mast and a horizontal jib, similar to 2 but with a different counterweight arrangement.

RESEARCH has brought leadership to Weber Group systems, for example, more Weber designed systems are being today than any other independent firm. And Weber is readying Group for safe systems to meet the star most critical requirements in which tomorrow's flight vehicles will operate.



**WEBER AIRCRAFT CORPORATION**  
a subsidiary of Weber Shovcom and Fletner Company, Inc.  
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- micro-miniature size
- high power rating
- humidity proof



The TKIMpec JR is built to meet or exceed government specifications for humidity, salt spray, vibration, acceleration, and shock. This potentiometer features a 15-turn screwdriver adjustment and 1/16", 0.010" diameter leads. The shaft-clutch assembly slides when the mechanical limits are reached, thus preventing possible damage from locking of adjustments. The TKIMpec JR is mounted with 2-56 screws through stainless steel rivets on 36" centers.

Delivering from stock. Send for complete Later Bulletin JR.



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OFFERS...



**"aircraft quality"**  
**DIAPHRAGMS**  
at no extra cost

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| 1. modern fabrics and elastomers | 4. higher operating pressures |
| 2. longer flexing life           | 5. larger diameters           |
| 3. wider temperature ranges      | 6. longer strokes             |

Designers of the long stroke, deep corrugation piston and, Bellofram offers designs and specifications, diagrams of current pressure profiles. New products and classic Bellofram diaphragms made by the most advanced methods, with modern fabrics and elastomers. Bellofram diaphragms are designed and manufactured to last longer and give substantially more flexing life... economically at a competitive price.

When designing for diaphragm functions, when specifying or ordering, important considerations should be given to the fact that "aircraft quality" Bellofram diaphragms can operate at pressures up to 300 p.s.i. (1) at temperatures as low as -110°F and as high as 300°F. They are available in 300 different sizes with a dimensional range of diameter and strokes. When more can be known, consult to your specifications. There are variations and maximum ranges of Bellofram diaphragms for design data.

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| Materials               | Practically any modern fabric and elastomer (from Nitrile Rubber to Polysilicone to Silicone Rubber and others) |

Whether you produce miniature parts or large valve products, Bellofram diaphragms can give added service life and better performance at no extra cost. We will be glad to quote on your requirements. For further information and technical data, write direct to:

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401-644-0000 EXT. 211 or 544-0001 (1 Day Mail Order) Ext. 211

**AVIATION CALENDAR**

(Continued from page 5)

- Apr. 24-National Automatic Mobility Automatic Production Forum and Aircraft Engineering Display, sponsored by Society of Automotive Engineers, Hotel Commodore, New York.
- Apr. 24-Spring Meeting American Rocket Society, Madison Park Hotel, Washington, D.C.
- Apr. 24-Third Annual College Industries Conference, State University of Iowa, Iowa City, Iowa.
- Apr. 27-28-46th Annual Conference, Aircraft Engineers, including sessions open to all, Hotel New Yorker, New York, N.Y.
- Apr. 22-24-Sixth Annual Jet Engine Symposium, Hotel Statler, Detroit, Mich.
- Apr. 22-24-Metallurgical Conference, International Metals, Norgeson General Plaza, 4th Floor, New York, N.Y.
- Apr. 25-26th Flight Test Symposium, San Francisco, Sheraton Hotel, Los Angeles.
- Apr. 26-Machine Reliability Conference, Meeting International Air Transport Association, Vancouver, British Columbia, Canada.
- May 14-Spring Meeting and Exhibit Society for Experimental Stress Analysis, Hotel Statler, Boston, Mass.
- May 15-16th Annual Conference, American Society of Naval Engineers, Sheraton Hilton Hotel, Houston, Tex.
- May 16-18th Annual Meeting, American Society of Mechanical Engineers, Sheraton Hilton Hotel, Houston, Tex.
- May 18-19th Annual National Forum American Helicopter Society, Sheraton Hotel, Washington, D.C.
- May 19-19th National Conference on Aircraft Engines, Sheraton Hotel, Washington, D.C.
- May 20-22nd Annual Design Conference, sponsored by the American Society of Mechanical Engineers, Sheraton Hotel, Washington, D.C.
- May 23-24th Annual Meeting, American Society of Mechanical Engineers, Sheraton Hilton Hotel, Houston, Tex.
- May 24-26th Annual Meeting, American Society of Mechanical Engineers, Sheraton Hilton Hotel, Houston, Tex.
- May 27-28th Annual Meeting, American Society of Mechanical Engineers, Sheraton Hilton Hotel, Houston, Tex.
- May 29-30th Annual Meeting, American Society of Mechanical Engineers, Sheraton Hilton Hotel, Houston, Tex.
- May 31-June 1st Annual Meeting, American Society of Mechanical Engineers, Sheraton Hilton Hotel, Houston, Tex.
- June 1-2nd Annual Meeting, American Society of Mechanical Engineers, Sheraton Hilton Hotel, Houston, Tex.
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**thermal thick**

The thermal barrier which now limits the speed of ultra high speed aircraft can be cracked. Needed: Structural components of elevated temperature alloys. Problems: Finding the right alloys, making them easy to forge and machine with regular production-line tools, maintaining uniformity of physical properties in production lots.

Right now, Carpenter is producing elevated temperature alloys which set new standards for consistent ability to meet tough aircraft specifications, high quality, improved forgeability and machinability. Engine builders find them ideal for more critical parts. Forge shops can work them to closer tolerances, get better finishes that require far less than usual machining. Work goes faster. Repairs are fewer.

You can get the full story of these alloys — their applications, fabrications and engineering properties — in the new booklet, "Carpenter Alloys for Elevated Temperature Service." Get your personal copy by writing on your Company letterhead: The Carpenter Steel Company, 123 W. 30th Street, Reading, Pa.

**Carpenter**  
**STEEL**

Improved alloys for elevated temperature service



tuned  
to the  
tempo of  
tomorrow



Open ears lead to the open thinking that made possible today's rocket powerplants. They are alert ears—ears acutely sensitive to the unsolved problems that must be conquered in designing powerplants for the vehicles of the future.

RMI puts a premium on just such thinking. Its engineers and scientists form a talented, alert team, efficiently and effectively meeting the rocket power needs of tomorrow.

**Engineers, Scientists**—Perhaps you, too, can work with America's first rocket family. You'll find the problems challenging, the rewards great.

Power for Progress



**REACTION MOTORS, INC.**

DENVILLE, NEW JERSEY



## Upstream!

Most people watching a salmon swim upstream wonder how he does it. Seems like a lot of exertion to move from one wet spot to another. To the salmon, though, the competitive drive system cannot be denied.

The titanium industry also has been fighting upstream these past five years. A succession of production rapids and metallurgical waterfalls have been surmounted. The dangerous hydrogen whirlpool was successfully tamed. The industry has now moved through the low white headwaters to fully competitive rapids with other advanced metals.

Titanium alloys of high strength, light weight

and outstanding corrosion resistance are available from T.M.C.A. in all wall forms and in a full range of sizes and gauges—sheet, bar, billet, extrusion, tubing and wire. Special heat-treated sheet of very close gage and thickness tolerances is in production for advanced aircraft and missiles.

Further expansions of sponge production and metal finishing facilities at T.M.C.A. are bringing titanium within reach of an ever-expanding market. Technical information and specialized engineering services are available for solving those applications having a strength, weight or corrosion challenge.

... FIRST IN **Titanium**



TITANIUM METALS CORPORATION OF AMERICA, 233 Broadway, New York 7, N.Y.









## HOW TO SAVE TIME AND MONEY ON COMPLETE BELLOWS ASSEMBLIES



No matter why or how the bellows principle enters into an assembly, Fulton Bellows can assemble the right bellows and related accessories or mountings into a complete device that meets your

specifications. In doing this Fulton Bellows offers important design help, specialized skill in joining bellows with other materials, and modern production facilities for on-time deliveries.

### BELLOWS FOR INSTRUMENT ASSEMBLIES



are available with diameters, lengths, strokes, spring rates, and charges to provide a wide range of movements in high or low pressure systems. In all applications the machine-fabricated bellows ensure continuing accuracy and safety of operation. For one thing, cold-working production methods give it maximum consistency for withstanding repeated cycling. In addition, its rugged design and the availability of multiple plating make the Fulton bellows better meet pressure and other conditions.



Send For  
Bellows  
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**Robertshaw-Fulton**

CONTROLS COMPANY

FULTON STATION DIVISION, ALEXANDRIA 1, TEXAS

FULTON BELLows HEADQUARTERS U.S.A.

**THOMPSON** *Extra-Landings Retreads*



### Thompson Retreads now in routine operation on the Viscounts

The superior performance of Thompson Extra-Landings Retreads on test, modern turbo-prop planes of leading U. S., Canadian, Central and South American airlines has not only established retreading as practical for higher-speed landings but has demonstrated that Thompson retreads provide the same high degree of safety, dependability and economy they have traditionally provided for other aircraft. Even now, Thompson has developed retreads for the still heavier weight loads and faster landing speeds of full jet aircraft.



**THOMPSON** *Aircraft Tire Corporation*

San Francisco 7, California

International Airport  
Miami 40, Florida

235 Bay Street  
Proper, New York



## Another Blow at Research

Mr. Frank D. Newbury has won his two year fight to become one of all military research, development and production programs. His victory is another in a series of blows to the state of aerospace research and development emanating from the top civilian levels in the Pentagon, blows that are seriously retarding the scope and slowing the pace of this vital effort.

We have already detailed the stagnulation of the research and development program caused by the constant level budget concept which has been accepted Department of Defense policy for the last several years.

## Newbury Victory

The Newbury victory is a symptom of another disease attacking the roots of research and development. This is a general downgrading and "jock-pooping" of the importance of basic research. It has its origin in older graduates of the American industrial system whose technical education came just after oil had given war its steam and more than a quarter century before the technical revolution wrought by nuclear fusion. These men who guide themselves on being "hard headed" practical engineers grew up in an era of American industrial development that was nourished on technical principles provided by the poor half century's basic research. The application of these principles to the great industrial complex where these men worked was so far removed in the time scale from the basic research on which they were based that the connection was virtually invisible.

Today the swift pace of engineering has just about obliterated the memory of basic scientific knowledge accumulated by a century of research. To maintain its technical pace, engineering needs an accelerated and expanded search on the basic frontiers of knowledge by the scientists. Without a major series of scientific breakthroughs all along the boundaries of the unknown, the vast and successful engineering and production effort of this country will slow down to a dangerous walk in the hazy future. The link between basic research discoveries and their application to weapon systems and the rest of the industrial system is now as close and vital that no modern engineer even raises the issue. The modern partnership of the scientist and engineer is a vital, delicate, difficult and basically new relation ship that must be nurtured, not divorced, if we are to maintain technical leadership for both war and peace. This is why the constant squeezing of basic research, the downgrading of important research posts in the

military structure and the resultant budgetary austerity imposed by the "hard headed" practical engineers whose technical outlook is limited to the steam turbine and internal combustion engine is producing such a dangerous threat to this science engineering relationship.

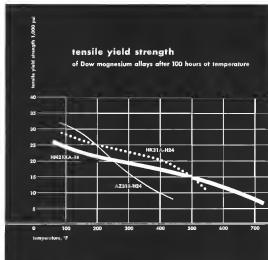
In addition to the elevation of Mr. Newbury to be overseer of all things technical in the Pentagon there is other evidence of this trend. After creating assistant secretary posts for research and development in all three military services, it has now been decided to do without at least one of the new jobs. In the Air Force, where the post of Assistant Secretary for Research and Development has existed for several years, the vacancy created by the resignation of Trevor Gardner is being over policies which Mr. Newbury heartily endorses has never been authorized to its post level. The post has been filled temporarily by Richard Bower, an extremely capable civil service career man, but his role has been vitiated by the handicap of serving not as an "acting" expert. There has been no move in USAF Secretary Quarters either to give Mr. Bower permanent status or the post or to recommend appointment of another permanent assistant secretary for the job. Thus in a simple bureaucratic maneuver the issue of research and development within USAF has been moved down several notches in the command echelon.

## Obstructionist Record

Mr. Newbury's own advertised astronomical development are well known to the aircraft industry. He latterly opposed such developments as the KC-135 jet tanker and the P68 jet drag boat. He authored a plan to erode development discussion on jet engines from paper designs instead of performance tests. He presented a scheme to delete new engine standards from his Pentagon office rather than rely on the fertile brains of the industry personnel experts. Over exhibited research and development man who had the benefit of Mr. Newbury's philosophies during Pentagon service maintained that this philosophy if passed to its logical conclusion would lead us to a policy of fighting World War III with the 1968 Model Springfield rifle because, "We are all tooled up for that. There are no development problems and it's a proven weapon."

Steady deterioration of the role of research and development in the Pentagon will prove to be a dangerous trend. It will make the Roman's stated goal of surpassing us technically much easier.

—Robert Hutz



## New magnesium alloy holds properties for 100 hours up to 700°F.

Dow Magnesium HM21XA-T8 extends further the range of conditions under which light metals can be used in aircraft design. Second in the series of three alloys designed specifically for elevated temperature applications, it supplements the excellent characteristics of HK31A alloy. HM21XA-T8 retains its properties at temperature during long periods of time. Tests are conducted hours at 700°F reveal an extremely little change in tensile yield, creep and elastic modulus.

Magnesium lightweight is combined with strength at elevated temperatures in HM21XA-T8, offering new ways to save weight or gain structural rigidity in the design of motors and aircraft. This alloy is supplied in the -T8 temper and can be formed in the temper without the need for further heat treatment after fabricating. Samples of HM21XA-T8 along with detailed information are available. Contact your nearest Dow Sales Office or write to Dow Sales Corporation, Midland, Michigan, Department MA 1430A-1.

YOU CAN DEPEND ON







## Head and shoulders above the rest



Wherever you fly... from Alaska to the West... the exciting new Fairchild F-27 propeller outperforms all other aircraft in its class. Fastest and most versatile short-to-medium haul aircraft, the F-27 is powered by airline proven twin Rolls-Royce propjet engines.

Tailored to the needs of the airline operator and the air traveler, its spacious pressurized and air conditioned cabin provides seating for up to 40 passengers. Cruising at 260 mph, the F-27 has exceptionally good short landing and takeoff performance. It's economical to operate, convenient to buy.

Address inquiries to: R. James Pfeiffer, Executive Director of Customer Relations, Fairchild Engine and Airplane Corporation, Hagerstown 15, Maryland

FAIRCHILD

**F-27** *Friendship*



THE FINEST AIRCRAFT FOR AIRLINE CORPORATIONS AND MILITARY SERVICES

## Washington Roundup

### Cause and Effect

Results of a press conference on tomorrow go army, as evidenced last week by press and stock market and subsequent reports made by Defense Secretary Charles E. Wilson.

At his press conference, Wilson said that what factor would be considered in any possible change in the production rate of Boeing B-52 jet bombers. The following exchange resulted.

**Wilson:** The question we have made ourselves with B-52 production, what we think the Russians may have made in their comparable airplanes and what the press says are for some new plans that we have got, particularly the B-55.

**Press:** Is the (Cassini) B-55 considered the successor plane to the B-52?

**Wilson:** Some people think that it is, and some people think it isn't. Depends on how much you want it and how you handle it.

**Press:** A competitor for the money though?

**Wilson:** Yes, largely.

**Press:** What do you think, sir?

**Wilson:** I could think better after I get the report of the test (of the B-55).

Next morning, two hours after the stock market opened, a news machine reported from Wall Street "Stocks of Boeing Airplane and General Dynamics (Cassini's parent company) moved widely on word that the government is considering replacing the Boeing B-52 bomber with a more modern plane."

"Boeing fell 3 1/2 to 4 1/2 while General Dynamics rose 1 1/2 to 2 1/2."

Still later, Boeing's stock had dropped by more than four points. By the end of the day's trading, however, it had recovered more than half its loss after the Air Force issued a statement that Boeing still had four orders for 552 B-52 bombers costing about \$5 million each.

### Ceiling Zero

Rep. John Moss (D-Calif.), chairman of the House Government Information Subcommittee, has asked Defense Secretary Charles E. Wilson to explain why a telephone recording of military weather forecasts ends with the instruction: "This information is for military use only and dissemination to the public is not authorized."

Moss points out that the telephone extension is posted on the front of the Pentagon phone book and that "anyone in the world" can obtain the forecast. "By giving the Pentagon from the money they get from the Kennedy office," Moss and his subcommittee has more serious a number of unusual applications of security, but this appears to be a new technique. He asked Wilson to cite his authority for this kind of "verbal classification." The subcommittee will urge the Congress Committee on Classified Information and its staff not work on their recent report on Defense security policies.

### Army or Wilson?

Army's sensitivity over its gradually rising role was demonstrated here again last week after Defense Secretary Wilson and Jupiter IRBM project has been "sanitized" for all practical purposes.

The memorandum was promptly denied by the

Army, despite the fact that Wilson already has asked that the Army-designated Jupiter will be operated by the Air Force when, and if, it is produced.

Both the Jupiter and USAF's competitive Douglas Thor will be produced, the Army said, and one or the other dropped only after an evaluation.

Wilson indicated that funds for the Jupiter might be sought only to finish "one baseline or two that we already started to prepare for." The Defense Secretary ruled in November that any money for the Jupiter in Fiscal 1973 would come from USAF, and it is not expected that the branch of the services will donate generously and willingly.

On the subject of local-based ground-to-air missiles, Wilson said it is up to the Army, to decide the relative merits of its Nike and the Navy-developed Volvo.

### Unprecedented Endorsement

Civil Aeronautics Board started the aircraft industry last week with an unprecedented endorsement of Fairchild's F-27 turboprop transport. The endorsement was issued in the form of a press release on official CAB stationery.

The release quoted CAB members, who had just toured Fairchild's Hagerstown, Md., plant, as declaring the F-27 is an aircraft that will give the "airline a chance to break rapid, short-haul transportation."

Member Glen Garney, for example, was quoted as saying the F-27 "will provide better service on a reasonable cost basis to the ultimate benefit of the citizen, the consumer and the general public." Harriet Derry and Chairman James Davis, the other two members who made the trip, were equally enthusiastic.

In the eyes of Fairchild, and its supporters, the press release was a nod in an official endorsement.

The CAB pointed out that Board members held a press conference last November after visiting the plants of Boeing, Cessna, Douglas and Lockheed.

A press conference, however, lacks the selling quality and staying power of an official release. One competitor's representative also complained that in the November press conference, the Board "continually refused from showing confidence for any one plane" but passed, instead, the progress of air development in general.

### Congress

House Armed Services Investigating Subcommittee's scheduled long look into military procurement practices (AWF Feb. 15, p. 174) got off to a slow start, guiding itself last week. Concern is that it will be several weeks before the probe moves into serious subcontracting practices. Other HSI developments:

• **CAB Appointment:** Public hearings on the nomination of Louis Hutter Jr. to the Civil Aeronautics Board are scheduled for March 11 before the Senate Commerce Committee. Then far, there is no evidence of any opposition to the appointment, although several Democrats have expressed their disapproval of the subcommittee's policy of appointing Eisenhower supporters to Democratic posts. Although a Democrat, Hutter voted for Eisenhower in both 1952 and 1956.

• **Collar Report:** The House Anti-Monopoly Subcommittee, which conducted lengthy hearings on air transportation last year, does not expect to make a report on its findings for another month.

—Washington Staff

# Wilson Order Hampers Research Effort

Furnas' post abolished; research and development effort placed under engineer-economist Newbury.

By Claude Witte

Washington—Frank D. Newbury, 76-year-old retired engineer with a devoted career toward research and development, was his last-year fight last week to control the Defense Department's R & D effort.

Departure from the Pentagon of Dr. Clifford C. Furnas, who left the post of Assistant Secretary for Research and Development to return to his job as chancellor of the University of Buffalo, gave Newbury his long-awaited appointment.

Dr. Furnas' old job has been abolished, along with Newbury's original post as Assistant Secretary for Engineering. In their place, Defense Secretary Charles E. Wilson created an Assistant Secretary for Research and Engineering and named Newbury to the position.

One of the country's leading scientists familiar with the situation and Newbury's career at the Pentagon told *Airways Week* that "Mr. Wilson is getting ready to fight World War II before, not to fight World War II!" This man and he was "disfranchised" and that "the wrong office has been abolished."

## Furnas Opposed Move

The change creates a situation that Dr. Furnas strongly opposed during his tenure. When he left his desk a few weeks ago, he indicated he feared that the engineering aspects of new weapons development should be under control of the Assistant Secretary for Research and Development. He further suggested that Newbury's office be abolished and its duties shifted to

a deputy of the Assistant Secretary for Research and Development (AW Feb 18, p. 25).

Indeed, Secretary Wilson, who also possesses a real attitude toward research and development, promptly moved Newbury into the top post.

Less than a year ago, Dr. Furnas threatened to quit when Newbury was given responsibility over technical aspects of development projects, "taking this away from the Assistant Secretary for Research and Development (AW March 5, 1956, p. 27). The order was withdrawn, and Dr. Furnas served his promised 18 months of duty.

## Emphasis on Engineering

Before Dr. Furnas, Newbury's effort to exercise more control over weapons as the development stage was opposed by Donald A. Quarles, at that time Assistant Secretary for Research and Development and now Secretary of the Air Force.

The almost inevitable emphasis upon engineering that will result under Newbury's rule will be a source of increasing friction to the Defense Department's staff of about 100 professional scientists and technologists.

Anticipating their real reaction, Wilson decided in his announcement of the change that the shift will cut down the contributions to the overall program. He also pointed out that the consolidation of the two offices was recommended by the House Committee.

Actually, the scientists are not disturbed by the change in the title of organization.

They are upset by the inclusion of

"engineering" in the new assistant secretary's title to the elimination of "development" and in the choice of Newbury to head the office. They fear the "wet and hot" approach will seriously curtail technological progress.

In his early Pentagon career, Newbury ran school of jet engine manufacturers with an attempt to establish strategic qualifications for gas turbines, regulating use and design, and at attempting to freeze them before possible development advances could be incorporated.

He is known to have opposed Douglas's RC-119 jet tanker program and blocked some work under the Martin P5M SeaMaster.

There was hope among scientists that Newbury's approach would be offset to some degree by appointment of William M. Holladay as his deputy. Holladay served for a year as assistant to Dr. Furnas and is credited with having a reputation as well as engineer.

Holladay is 20 years younger than Newbury and while he has been involved in research and been associated with professional societies such as the Society of Automotive Engineers, Institute of Chemical Engineers, Society for Testing Materials and the Industrial Research Institute, he has been active in the National Advisory Committee for Aeronautics, specializing in aircraft fuels and powerplants.

Newbury's background is almost exactly that of the engineer, scientist, manager and economist. He graduated from Cornell University in 1901 and spent his entire career with Westinghouse Electric Corp. In 45 years with that firm he rose to become a vice president and member of the board. His major experience was in the design of steam turbines, management and administration.



Frank D. Newbury



## Grumman Turns TF-1 into WF-2

Grumman WF-2, an early warning modification of the TF-102 Tracker, mounts 551 electronic alloy skin antenna above fuselage on prototype. Facilities versus antenna probably will be flexible honeycomb sandwich. Radome directed complete redesign of tail to provide true vertical line at stabilizer tips. It also meant redesign of wing folding geometry because of interference of antenna with folded outer panels. Other changes wing mid-section modification for additional fuel; 25 in. extension of fuselage forward of wing to improve antenna balance, new wheel strengthening, complete tail wheel collapse because WF-2 becomes tail wheel airplane with wings folded. WF-2 is a dual role, first plane replaces two pilots, two operators. One pilot serves to control antenna's rest, otherwise unoccupied, during operations. Hamilton Electronics Corp., Little Neck, N. Y., will provide radar equipment. Grumman submitted design Jan. 25, 1956, first prototype in test this year.



## Why Newbury?

Washington—Defense Secretary Charles E. Wilson may be appointed Frank D. Newbury to the new post of Assistant Secretary for Research and Engineering because "he was competent to do the job and he was available."

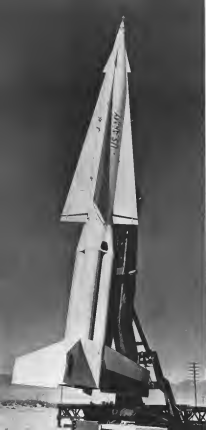
Wilson also told a joint conference that the new assistant secretary "has no authority to operate, or make" the job, the Pentagon has decided to let Wilson on what should be done, "and whether it is done or not is up to the secretary, and the services and the people that do it."

Newbury's big asset, according to Wilson, is in his administrative and executive ability. Wilson also indicated that the Defense Department has previously no research activity, that most of it is in the hands of contractors, laboratories and schools.

It is so stated that Newbury and Wilson hold similar views on the value of research to the defense effort. Secretary Wilson says he is not buying "cheap" research, but that he favors "directed research" as opposed to "pure research." He felt, and Newbury is in agreement, that defense funds should not be spent on research projects that do not appear vital to the defense effort.



## Longer Range Nike Carries Atom Warhead



COMPARISON of Nike Ajax (above) and Hercules (left) in their transport cradles shows design changes which give latter model greater operational performance. Changes include wing planform, control system, low-velocity tandem booster and boosters for body length increased and diameter is more than double Nike Ajax.



**SOME HERCULES**, carrying a nuclear warhead with higher speed, altitude and range performance than its predecessor Nike Ajax, greatly increases the Army's anti-aircraft capability. The new missile shown at launchers (above) and during firing tests (below), is officially scheduled to become operational in the "definitely near future."

Its range of more than 50 mi., and improved altitude performance will enable scheduled Nike batteries now targets in range for most modern aircraft before they reach their battle station goals. This was not possible with Nike Ajax. The nuclear warhead under each missile effective against a formation rather than a single plane.

Existing Nike ground control equipment may be used with the Hercules after some modification, which also accounts for the differences of Nike Ajax. Hercules wing planform indicates that its operating Mach number is substantially above the Ajax. Control controls of the new missile have been re-placed on the Hercules with fixed forward slumping fins and movable surfaces on the wing trailing edge. Nike Hercules has extreme maneuverability at altitude. Nike Ajax short range of Nike Ajax during tests has been approximately 35 miles (AW) June 4, 1950, Nike Ajax was Nike I, Nike Hercules was Nike II.

Western Electric Co. is prime contractor for Nike Hercules, and builds ground guidance and control equipment and missile guidance at its Washington and Waukegan (Ill.) plants. Douglas Aircraft Co. is producing the missile at Santa Monica, Calif.







SEQUENCE CAMERA TRACKS F-4s as they (below) land under control of Bell-developed Automatic Carrier Landing System.

## Bell System Permits Hands-Off Landings

By Evan Clark



320 HEARS TOUCHDOWN under control of ACLS, whose mobile units are shown in lower photo. Equipment, housed at sea and far from shore, actually occupies very small volume.

Bell's N. Y.-Bell Aircraft Corp. attached an automatic carrier landing system last week that allows hands-off landings on sea-air-sea.

Developed for Navy's Bureau of Ships and USAF's Air Research and Development Command, the system is easily applicable to any modern aircraft containing either an instrument landing system or a radio altimeter or data link automatic control system.

Both the Air Force and Army have shown interest in its application to helicopters, and several mobile units between have indicated interest in the system's use for surveillance radar.

More than 1,200 successful landings have been made since May 8, 1954, with a Douglas F4D, North American F-86 and B-24, a Convair 440 and a Corsair II.

The Navy system will go aboard a carrier shortly for sea trials. The first system proved acceptance tests in land-based trials at the Naval Air Test Station, Patuxent River, Md., in September 1954. It passed Air Force acceptance tests at Rome Air Development Center, Griffis AFB, N. Y., shortly afterward. Bell President Leroy P. Fiskel termed the development of the system a "tremendous technical breakthrough."

Both the Civil Aeronautics Administration and Edward P. Carter, Airframe Facilities Planning Group, have followed development of the landing system.

Its simplicity and the ease of

adaptation to existing commercial designs give it a high potential for civil service use, a Bell spokesman said.

The only addition necessary to prepare an aircraft for use with the system is the addition of a course radar reflector which holds up with the landing gear. An eight pound support console can be added, but Bell has found that pilots generally prefer to coordinate their own approach.

Both the pilot and the single liaison console who would oversee ground operations can oversee the system automatically. Automatic control of wave off is an option of a future system in a specification of the Navy system.

The carrier system will include a radar data substitution unit which, in effect, will allocate from the system the millipeds and one of the ship's computers for the motion of the carrier's deck and allowing for wave side landing when those made by a pilot.

In the 1,200 test landings made thus far, Bell has found that the system can put a plane down within 32 ft either side of the carrier's threshold and within 32 ft of the edge of the deck during landing approach for carrier-type landings. For fixed landings of the type used by land-based aircraft, the figures are plus or minus 10 ft and plus or minus 10 ft.

The system also works well with existing landing aids including Tacon, ILS, GCA, Vane, surveillance radar and low frequency aids.

Basically, the system operates this way:

- Radar positioned behind the runway picks up the plane as it passes through "wavefronts," or "pips," in space in line with the runway and two miles out in the case of carrier, in four miles out in the case of land-based planes.
- Computer containing alt alt, pitch and yaw parameters for an approach and landing, corrects actual altitude data from the radar.
- Using radio signals sent to the plane's autopilot through data link or ILS, the computer sends out correcting data. The autopilot then steers the plane to touchdown. Control can be maintained for more than 100 ft after touchdown if desired.

The system is an outgrowth of data link work carried on at Bell in the mid-1940s and in an attempt to develop an automatic system for designating flight test work—specifically, with the jet F-50.

In 1949 and 1950, Bell did data link development for Chance Vought's Reg and F-106. In 1950 and 1951, Navy's Bureau of Ships and the Air Force became interested.

A Navy development contract and an Air Force development program were initiated. The Air Force later dropped out

as far as supporting funds were concerned but continued to watch development and, approximately two years ago, awarded a major contract. Since then, it had decided to purchase a few test articles.

Bell began the development of the landing system largely in John G. Gossard, Bell's electronic engineer who left Bell less than a month ago to join Sperry Rand Corp., of Bellville.

The group leader is now Harold Fletcher. Another group leader is Gerald H. Hils. Robert Thayer and Herb Merson are project engineers.

Bell won a competition for the system from Minneapolis-Hannibal. It was much of its success is due to the fact that it had previously had its stepped equipment that was considered unreliable. Much of it, of course, has been modified.

Computer in the original system—while the company now considers no longer experimental but "made for up around seven or eight years' time. Data link is Bell's own development. The autopilot is a greatly modified Bendix

## Digital Computer Leads Analog In Weapon Control Use Trend

By Irving Stone

Los Angeles—Trend in weapon control is toward digital computer, because of its greater flexibility, higher accuracy, lower cost, better reliability, during machine and lower requirements for skilled manufacturing labor.

This trend was pointed out by James M. Bridges, director of electronics in the office of the Assistant Secretary of Defense Engineering, at the 1957 Western Joint Computer Conference. It follows, he said, that cooperative effort of the military and industry could be used in the immediate goal of streamlining design of digital computer hardware building blocks for weapons control applications.

Changes in digital computing techniques for weapon control is both desirable and desirable, Bridges and Bureau of the rapidly increasing complexity of weapons of all kinds digital methods offer the greatest promise for solving the control problems, he declared. State of the electronic component art justifies the development of digital designs for all new weapon control programs, he said. In the future, using weapon control will give a minor role in support of digital control, Bridges believes.

"I don't think it is fully appreciated in the weapon control field that the digital computer presents many advantages over the analog design in addition

to its greater performance capabilities," Bridges declared. The digital computer has far greater flexibility than an analog device, he said. A single basic computer design, with only minor modifications, can handle the operation of a number of different weapon control problems, he said. This capability has very significant implications with respect to standardization of design, simplifying engineering effort, increasing response reliability and better production and logistics.

Bridges outlined this comparison in an address before the Western Joint Computer Conference. He said that the digital computer is a device in development for an analog computer in an existing building/complex system. Quantitative production costs of the digital computer will be about 40-50% less than that of the analog. Capital equipment for production of the digital computer is expected to be reduced by 75%. Skilled manufacturing labor should be reduced by about 75%.

Lead-time for new production is expected to be cut by 60-75%.

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## New RCA Radar For Missile Test

New York—Precision radar system, designated AN/SPS-36, has been designed by Radio Corporation of America to track guided missiles accurately over extended ranges in all weather conditions and display data that can be reduced rapidly to final form.

RCA's instrumentation radar is designed to track targets with as without human intervention and produce optical and coordinate data outputs of high accuracy.

AN/SPS-36 equipment, developed by RCA's Missile and Surface Radar Department, Mountaintop, N. J., will be installed in a fixed station and housed in special enclosure. The radar platform is designed for lowest mounting, as dictated from the enclosure to minimize transmission of radiation. The equipment was designed to a joint services specification under a consolidation of U. S. Navy Interim and Army Signal Corps contracts under Navy acquisition and is now being produced for Air Force, Navy and Army test ranges.

built up precisely stated requirements of the general purpose radars. As in any new and highly specialized branch of engineering, he declared, there is a tendency here that a highly broad group of specialists may be doing, working in their own language and not tending to have extent to focus away from other branches of the electronics industry. This has the effect of decreasing the interchange of technical experience, a potentially serious detriment to both reliability and maximum performance of digital computers in weapon control systems. Designers warned.

## Donnan Is President in Shakeup

Douglas, Come-Top management shakeup of Donnan Helicopters, Inc., has been initiated by stockholders as an attempt to improve the company's net assets before.

Top executive now President Donald S. D. Watson, replaced by Gladden S. Donnan, former vice president-engineering. A new board has also formed, comprising Donnan, G. P. Fisher, vice president-engineering, L. H. Snyder, D. S. Phillips, C. G. Dodge and Stephen D. Pratt. One or two additional directors may be named later.

Immediate future plans of the company will include increased effort to obtain additional military research and development contracts further subcontracting, and an attempt to build a current backlog of commercial products.

"We can waste a lot of time and engineering resources in this incredible transition from analog to digital computing techniques if we do not make continuous and constant use of the weapon control know-how that has been built up in this country over the past span of a century," he said. In the conclusion, it is interesting to note that a few representatives of many years experience in designing military control devices have entered the digital field during the past few years with outstanding successful results.

"We can tell you even greater lessons of the proven reliability concepts and techniques established through years of hard work and cooperative effort on the part of industry and the military, developments are not applied in the fullest extent in this military digital computer field."

Braden pointed out that he was convinced that, using present techniques and components for design digital weapon system computers which will be more reliable than the best electronic equipment now in service.

One of the most promising techniques for obtaining reliability in digital computers appears to be the exploitation of their basic inherent flexibility in developing standardized designs of system building blocks, he declared. These systems of many weapon control problems is quite similar and can be solved by proper system grouping of similar computer elements. Such a standardized design, he declared, would make it unnecessary to develop a completely original computer for every new weapon system project and would permit the use of standard computer elements of proven reliability. This capability could be brought to a very high level through extensive engineering, testing re-engineering and continued production.

rather than the present American licensing patent system. Donnan has worked out a new patent specification around this engine to meet the French requirement.

Donnan said that for his built only two YH-31s, the Army version of the LZ-5. One is undergoing further evaluation by the Army, the second was scheduled for delivery to Ft. Rucker, Ala., last week.

The Donnan spokesman stated that the recent success in its stockholders will have no effect on the Canadian company, Donnan-Flex Helicopters, Ft. Erie, Ont.

## Aero Design 560-E Has 222-Mph. Speed

Bethany, Okla.—Superior to the Aero Commander 560A light twin business plane, the 560-E with range increased to 1,615 mi and top speed of 222 mph, is being put into production immediately by Aero Design & Engineering Corp.

High aspect ratio wings, five feet longer than the 560A's 44 ft, span are the most noticeable change in the new 560-E, which replaces the previous design in the production line here. Gross weight is 6,500 lb., a 500-lb. increase.

First production 560-Es are scheduled to be completed by June. Powered with 267 hp. Lycoming high compression engines, the 560-E will sell for \$79,900. Aero Design will make a cross-country kit available in six months to 560-A owners also wish to incorporate their upgrades to 560-E configurations. The conversion will cost \$26,600.

## Supercharged Lycomings To Get Free Revolt

Bethany, Okla.—Modernization program aimed at solving piston engine problems in the supercharged Lycoming GS604-type engine has been developed by Aero Design & Engineering, Lycoming and Bethany and will be made available in six to ten Aero Commander 460 engines.

This is the result of an extensive test program by the manufacturers to determine the cause of several engine failures (AW Jan. 31, p. 117).

Lycoming will supply necessary replacement parts for the engine. Aero Design will ensure that costs. Engines will be equipped with piston coating to meet corrosion and improve reliability, rather than with Wolframite leads in steel corrosion will be fixed, the carburetors will be test in Bethany for new re-plated carburetors and improved throttle shafts and linkages.



## TRAIL, BLAZING—Many frontiers of science have been charted by Northrop

Aircraft engineers and scientists in seventeen years of research and development of manned and pilotless aircraft, Northrop Snark SM-62, first intercontinental guided missile can be disclosed by the U. S. Air Force, are now flying from the Florida coast over the USAF missile test range. Northrop's newest trail blazer is a supersonic theater designed to help pilots master the complexities of tomorrow's combat aircraft. Other Northrop trail blazers include Scorpion F-59 interceptors; jetless target aircraft and missiles from Northrop's subsidiary, Radoglass Company; ground support and armament equipment from the Anaheim Division; and entirely new concepts of integrated weapon systems which are constantly being initiated to improve our national defense.



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MAP shows 6,977 nautical mile Copenhagen-Tokyo route over North Pole. SAS DC-8C flight requires 10 hr, one stop.

## SAS Opens New Trade Route to Orient

**Inauguration of Copenhagen-Tokyo service brings first crossing of North Pole by commercial planes.**

By Richard Sweeney

Copenhagen-Sandness Airbase Service opened a new trade route to the Orient last week with inauguration of its Copenhagen-Tokyo service via the North Pole. The SAS polar route, cutting 25 hours flying time from conventional air schedules between Europe and the Orient, is a major expansion of this airline's exploitation of Arctic routes as new intercontinental trade routes.

Two DC-8C aircraft, dispatched from Copenhagen and Tokyo, met over the North Pole. It was the first crossing of the North Pole by commercial planes.

### Shorter Route

The 39 hr, 6,977 nautical mile trip compares with 51 hr required by direct SAS's 8357 nautical mile route to Tokyo via Europe, the Middle East and Southeast Asia.

Ahead the commercial aircraft "Global Express" liner were Pioneer Motors of Japan, longest brother of the company, its vice, high Japanese government officials, and SAS executives. On the westbound aircraft were Pioneer

Airl and Foreign Minister H. C. Hansen of Denmark, government officials of Denmark, Norway and Sweden, which opened their national markets to 1946 to create SAS. The eastbound plane departed Tokyo International Haneda Airport at 0915 Japan time, enroute 12 hr to an airtel for the 5,135 nautical miles to Anchorage, Alaska, the route's first scheduled refueling stop. Allocated an airtel was 10,000 ft. The flight started with head tail winds and reduced power to maintain schedule. A wind shift along the Alaskan coast yielded 10 mph headwinds, resulting in an elapsed flight time of 12 hr, 12 min.

### Anchorage Stop

Anchorage refueling ceremonies were well attended despite the local hour-long daylight. While SAS only changes crews and refuels there, Anchorage citizens have about Washington has passengers indicate signs for SAS, buying souvenirs will use the duty airport Seattle Anchorage flight, due over in Alaska, then continue to Europe or the Orient. Anchorage ground crew approximately 11 hr. No landing gear used for aircraft as engines and SAS has found that standard ground handling

equipment should be adequate for all expected circumstances. First night from Anchorage to 16,415 ft, 14,145 under the maximum allowable takeoff gross of 142,360 lb. Anchorage departure was at 0415 local or 1415 Greenwich time. Due over the Pole at 2145 GMT, the plane met continued headwinds and crossed the entrance to 2145 GMT as arrival time. Actual arrival at the pole was 2147 GMT, slightly behind the scheduled plane. Continuous airfield winds ranging from 30 to 70 mph forced the continued plane to drive more power to hold schedule. This resulted in an unpowered landing at Oslo by fuel, with some Capt. G. Lind observing the SAS fuel regulations specifying 7% route reserve plus 3 hr holding fuel on arrival at destination. Elapsed time, Anchorage to Oslo, was 16 hr 45 min, for 3,500 nautical miles.

### Alternate Tracks

Although the inaugural flights both follow a track, many others in the geographic pole, SAS has a set of flight paths for the Anchorage-Copenhagen segment. One major course passes over the pole, the other bypasses the pole slightly on the Greenland side. In addition, 500 or more miles are available for alternate airports in Norway and Alaska. Taking about half required by

regulate the aircraft departures. Only at 1714 GMT, arrived at Copenhagen at 1816 GMT (1915 local time). It was late but planned for refueling enroute at Kastrup Airport. Total flight time was 30 hr, 7 min, 12 sec at Copenhagen.

The refuel food service was scheduled according to Japan time, since passengers were accustomed to eating at these times. Results was that in the polar region, where time change, instead breakfast was served at midnight, local time, lunch at 6 AM local time both in total distress.

#### World Rights

From Tokyo the western flight was to continue around the world to SAS Southeast Asia Europe route, arriving back at Copenhagen in 80 hr. Interruptions at the polar region allowed 15 enroute flights over the polar area proper and more than two years open total experience in Arctic flight over SAS on its Los Angeles/Copenhagen route via Winnipeg, Greenland. Service on the older route was inaugurated with DC-6Bs with a normal range of 3,000 mi.

Start of the polar proper route revealed identical with DC-7C aircraft with a normal range of 3,800 mi. In addition, SAS used the DC-7Cs on its North Atlantic route from Copenhagen to New York, and the Copenhagen-Los Angeles Arctic route to get a line of weather operations with the aircraft, which are Wright R-3350-RAI Turbo Compound engines and different electrical standard practices than the Douglas DC-7. The latter's color weather operations showed the line a number of problems which resulted in several modifications to the aircraft. SAS DC-7Cs at the Douglas factory for polar flight.

Included were special attention for all water tanks and tanks for the electrical fluids to prevent freezing, use of plastic tubing in some locations so that possible freezing would not rupture lines. Another in the line found necessary was on the propellers. Prolonged cold soaks during flight at negative temperatures of -40C resulted in ice buildup on the propeller hub alone, turning the prop into fixed pitch. Solution was incorporation of a second bleed hole and relief valve admitting warm engine oil to the damper hub.

Not yet mentioned but due for air certification for test is dust-laying, allowing which will keep the oil that should land blind holes because plugged or clogged.

A second propeller problem was to the governor, where distance units had been used in moving parts. Use of metric with the more consistent of European and conditions notified that in red section the governor was

readjusted for extended low temperature operation.

Another situation under close scrutiny by SAS is the blade pitch lock used on this could possibly. SAS took it is possible that the very small blades in a blade angle between normal 2,000 rpm for takeoff and the setting of 5,000 rpm, where the pitch is supposed to engage to prevent a runaway engine, was result in the blades going into the pitch of idleness. Present SAS and manufacturer calls for using the propellers from their crane condition of being closed to either No. 2 or No. 1 engine to independent operation, and replacing manifold pressure control on each engine to produce a drop in rpm should the prop be in lock pitch. Since reinforcement of the governor, change of metal to compatibility in the governor and installation of the bleed bleed lock and check valve, SAS has had no problems in these specific areas.

In its Arctic flight experience, SAS has found that the improved cooling of DC-7C engines with the large prop governors will stop cylinder head temperatures due to the excessive reflected on instrument dash-100C. However, prolonged flight at 110C far from the 100C has led to the cylinder head has produced no unusual results so far.

The temperatures occur at cruise power long range maximum setting and cold days had cloud.

#### Grid Lines

Another feature of the TAI engine is the observation of coherent light problem in the grid region.

Reducing most of the world's grid side air routes now well covered, SAS early in its history sought a route it could power which could establish grid lines in the Arctic, and the public mind before competition became too heavy. Arctic routes to the U.S. West Coast and the Soviet seemed feasible of the three main obstacles to polar airports—a proper runway, accurate and reliable timing data and a device to prevent problems when celestial sights were impossible—could be overcome.

SAS selected its aircraft by attempting a system of grid lines which could be operated on a pusher prop system with its winging the polar area. The Arctic region and the lower latitudes of the North Atlantic give the grid system in the sense in that used in USARF in its polar flight operations. Using the grid system, the polar navigator can go to any location according to grid direction, which results in a great circle route over the ground.

Since the magnetic compass is unreliable in the area it planned to go, SAS used Beards to develop a grid with random drift of less than 2 deg. At Beards, came up with the

Polar Path gyro, which has satisfactorily proved in service it can hold a line that verifies the magnetic field. Since Polar Path is interconnected with the autopilot to provide automatic course correction during the grid flight Polar Path cannot be used by having a switch, but the course reading is grid direction rather than a standard oriented direction.

Building the Polar Path, SAS decided to develop an electronic and which would compensate for gyro precession due to latitude. This was provided with the average latitude picture normally set in the system.

Kalifornia Instrument Co. provided SAS with the Kalifornia Sky Compass which utilizes the polarization characteristics of reflected light to give the navigator accurate position. It is called the known star April and Star transfer in the Arctic, yet lights the sky too much for military secret this firm.

SAS navigators who practiced grid navigation learned that high order course accuracy with Polar Path was not keeping a graph on modern precision 70C has led to the use of the compass (see left) under the compass 2 deg for reference.

Kalifornia Sky Compass foundation too also was accomplished. SAS first suggested the Los Angeles-Copenhagen route via the Arctic, with stops at Greenland and Winnipeg, Canada, and DC-6s.

Since start of Arctic experience SAS has arrived at a new method of navigation.

Reducing most of the world's grid side air routes now well covered, SAS early in its history sought a route it could power which could establish grid lines in the Arctic, and the public mind before competition became too heavy. Arctic routes to the U.S. West Coast and the Soviet seemed feasible of the three main obstacles to polar airports—a proper runway, accurate and reliable timing data and a device to prevent problems when celestial sights were impossible—could be overcome.

#### Reds and Gyro

On the eastward magnetic DC-7, combination of sides and gyro local magnetic field is used to determine the grid line.

When the plane left Anchorage, the autopilot was put on DC-7's lower pressure with the VOR tuned to that station's frequency. When the plane was crossing the coast of Alaska, the autopilot, the navigators established a grid course which would take the aircraft into Copenhagen, oriented his Polar Path gyro in this, and switched control from local to gyro without the gyro circle route over the ground.

In more recent navigators will avoid Polar Path gyro with respect to the island reference when about to enter areas where Polar Path direction error

is indicated. SAS currently has Beards X-band, Gofin G-band and RCA airborne radar sets undergoing tests flying today in DC-7Cs. Also about are ANV-25 sets. Possibility of using ANV-35 combined with X-band in the center mapping configuration is under consideration as one means of a low order circle indicating check, a navigational aid independent of ground conditions (polar temperature variations have been known to produce clouds up to 20,000 ft occasionally) and line of atmospheric influence with first order reliability still is needed. Normal polar flying altitude is excellent above 10,000 ft. SAS has found.

Clearly high pressure covers the Polar Path as low in latitudes and winds are low in velocity and fairly dependable. Usual prevailing temperatures at flight altitudes between 12,000 and 20,000 ft range between -50C and -80C.

To keep in contact with its planes at all points along the polar routes, SAS has built a number of 24 hr. high frequency stations. Stations are at Anchorage on the north tip of Norway, Island on Spitzbergen, Nord and Danes on Greenland, Resolute Bay on Cornwall Island north of Canada and Point Barrow, Alaska, in the Soviet area-Doris route. Older stations which SAS helped open include Agassiz, and Sverdrup on the southern half of Greenland and Proby Bay, Greenland, and Winnipeg in Canada for the Arctic run to Los Angeles.

Sharing in the stations with SAS were Narayagan, Danes and Canadian



#### Vickers Delivers 60th Vicoast to Capital

Final Vicoast of original Capital Airlines order of 60 airplanes yesterday left for Vickers Armstrong, Seattle. Capital Vicoast is a four-engine propeller aircraft. Original schedule called for delivery of the last Vicoast by the end of this month. Vicos were completed on Sept. 19, 1957, ahead of schedule. Last July the airline ordered an additional 15 of the turboprop Vicos, with delivery to be completed by April, 1957. Total order of Capital's order is 75 Vicos.

government and West Alaska Airlines.

Ground were transmission which have a range of 700 mi and cannot be limited but by atmospheric ducts were caused by sun spots are located at Anchorage, Island, Danes and Point Barrow. Using these stations plus a listening post from Alaska to Copenhagen via New York, the polar flight should never be out of contact with headquarters at Copenhagen. Although intended primarily for service and other voice data transmission to polar flights, the stations can be used to launch extreme for radio fixes under certain conditions.

Despite the fact that SAS will never be more than 24 hr. flying time from at least one of more than 10 USARF and RCAAR military airfields which are the northern coast from Alaska to Greenland. Although the base is small, the magnetic field was not as affected, SAS has in addition, should a crippled aircraft be unable to reach a base, the radio fix has an excellent rescue service in the Arctic region.

#### New F-27 Order

Boeing, MA—An order for three F-27T turboprop transport planes, one of T-404H jet transport on the way to Pilling, MA. The order is for three F-27T turboprop transport planes, one of T-404H jet transport on the way to Pilling, MA. The order is for three F-27T turboprop transport planes, one of T-404H jet transport on the way to Pilling, MA.

The Southwest order brings total sales of the F27T turboprop to more than 10. The order is for three F-27T turboprop transport planes, one of T-404H jet transport on the way to Pilling, MA. The order is for three F-27T turboprop transport planes, one of T-404H jet transport on the way to Pilling, MA.

# Military Details Future Navigation Needs

By L. L. Doty

Washington—Current air navigation systems that can control and identify missiles and aircraft traveling at speeds of up to 2,000 kt. will be a military requirement by 1964.

In a paper presented to the Navigation Panel of the Air Commanding Committee, USAF has outlined in broad concepts the joint military needs for an air traffic control system that will operate in any mountain from an aircraft operating in a common range with civilian.

The paper specifies the joint requirements of the Air, Navy, Coast Guard and Air Force. It does not include recommendations for technical single-mission of the system.

## What USAF Wants

Essentially, the Air Force wants an air traffic control system that will handle aircraft with these characteristics:

- Operating speeds between a hovering rate and 2,000 kt.
- Altitude ranges between a minimum height above the ground and 100,000 ft.
- Capability of changing altitudes at rates as high as 100,000 ft./min.

- Takeoff and landing speeds that vary between 40 and 200 kt. and requiring airports capable of handling vertical-takeoff aircraft and those using runways up to 10,000 ft. in length.

The system should provide navigation service to an "undefined" number of aircraft at all altitudes, according to the paper. In actual usage the Air Force wants an air traffic control system that will handle landing aircraft at 100 kt. and up to 100 kt. per minute for climb, cruise or descent.

The paper also calls for a positive means of identifying all aircraft in the terminal area without the need for any communication. The system, it added, should include a means whereby controllers can verify in three dimensions all traffic within the terminal area to a distance of 100 nautical miles and up to 150,000 ft.

The Air Force wants a simple display system for pilots that will give heading, altitude and speed to be flown in the terminal area.

In an acute traffic control the Air Force asks for an adequate number of radio ground communication channels to prevent delays in the transmission of position reports. A radar data link, it suggested, is a means of achieving this requirement.

The paper calls for direct pilot-to-pilot communications within the parameters of the air traffic control and control system. However, it sets out

be automatically reproduced in the cockpit with continuous display of the information in the navigation panel. Positive control of all traffic, positive traffic data and flight safety in descent is implied in the report. When necessary, parallel flight paths should be used and the system should permit control of aircraft on any desired flight path within the operational capabilities of the aircraft.

The paper urges retention of flight data that are beyond the capacity of the system or conflict with others. It describes a need for automatic monitoring and control of clearance.

The report says the navigation system should include long-range elements that are operational up to distances of 7,500 nautical miles and should be sufficiently accurate to permit a protective block of airspace of one mile around aircraft in terminal areas extending to five miles at the maximum 2,500 aircraft total range.

The system also should protect vertical spacing of aircraft at 500-ft. levels below 10,000 ft., and 1,000-ft. levels above that altitude. Changes in speed along trajectories by the pilot should be required no more often than once every 100 ft.

Modification of airport design criteria was termed essential to insure rapid clearing of aircraft.

The Air Force also wants sufficient time to facilitate the flow of traffic into and a better means of handling each traffic under all weather conditions.

## Specific Requirements

The system should be available for full operation by 1964, the paper says. Air research and development is underway for the program, the Air Force noted for these specific requirements as a baseline for the system.

- Size and weight of transmitters, receivers and electronic equipment must be designed to be reliable without unduly increasing performance.

- Reliability of the system must be degraded so as to deny they are not necessary, as well as still provide service for friendly aircraft. The Air Force stated "This doctrine that compromises of the system elements must be such that the system is still usable in the event of short periods, and after capacity full activity must be in full force again."

- Simplified maintenance requirements for both airborne and ground equipment. "The Air Force suggested in 'highly desirable' the 'go-go' testing system and plans its replacement at present.

• Systems and procedures used in air

traffic control must not prevent an aircraft from operating in maximum performance.

- Ground components should be easily adaptable to mobile use.

- Traffic control system must be designed to permit integration with the Air Defense System, Federal Air Command System and other federal means of controlling air traffic. It should have the capability of handling such tactical missions as air defense and search and rescue. The system also should be able to accommodate air traffic moving from an aircraft carrier to a point within the control of the command system.

## Coach, Cargo Traffic Lead Airline Growth

Washington—Coach passengers and cargo led the way in the growth of U. S. scheduled air traffic during the 10 year period from 1946 through 1955.

The Civil Aeronautics Board report that cargo tonnage carried in scheduled service climbed from 54 million in 1946 to more than 454 million in 1955 for an increase of 708.7%. Coach passengers in 1946, the first year of such service, amounted to approximately 5 million. In the end of 1955, the figure had climbed to 9.5 million for an increase of 500.4%.

Other percentage growth figures:

- Revenue tonmiles for all services increased from 1946 to 1955 by more than three billion tonmiles in 1955, an increase of 280.6%.
- Revenue passenger-miles climbed from more than 7 billion to over 24 billion, an increase of 245.4%.
- Total operating revenues, including both service and passenger, increased from just over \$461 million to more than \$1.1 billion, an increase of 143.1%.
- Mail-tonnage revenue passenger-miles reached 7 billion in 1946 and almost 15 billion in 1955, an increase of 100 million tons.
- U. S. mail tonnage accounted from more than 18 million to over 143 million, an increase of 264.3%.
- Unemployed tonmiles operated increased from 129,426 to 192,997, an increase of 44.3%.

- Number of aircraft in service with scheduled routes increased from 317 to 1,645, an increase of 76.4%.

- Investment in flight equipment, excluding mail and ground equipment, increased from \$105 million to more than \$543 million, an increase of 413.9%.

- Number of persons employed by U. S. carriers grew from 90,774 in 1946 to 125,970 in 1955, an increase of 31.9%.



First Comet '3 1/2' Rolls Out

First picture of the roll out of the de Havilland Comet "3 1/2," prototype of the Comet 3, shows the aircraft at Heathrow Airport, London. Powered by Rolls Royce RA 29 turbojet engines, the aircraft will be used in passenger service beginning in late 1958. In the U. S., Capital Airlines plans to operate Comet 3 service in early 1959. The value has for Comet 3 and 10 Comet 3A on order. The aircraft has made its first flight last week. The first flight was the improved control system handles differently than the earlier Comets, but it is said the 28 ft. section flight was "satisfactory in every respect."

## Capital Reports Net 1956 Loss Of \$1.8 Million After Plane Sales

Washington—Capital Airlines last week reported an operating loss of \$2,864,000 during 1956 and a net loss of \$1,793,000.

In announcing the year-end results, Capital President J. H. Carmichael attributed the loss to costs involved in the introduction of the expanded fleet of Viking Viscount turboprop transports and in "developmental mileage as a result of recent route adjustments."

The net loss represented the balance after the inclusion of a special income of \$2,455,000 from the sale of piston engine aircraft. The company with an adjusted net profit of \$4,562,276 in 1955, realized a special income of \$4,595,551 earned primarily from the sale of aircraft. The airline reported an operating profit of \$315,341 in 1955.

## Gross Revenues

Gross revenues for the year climbed 25% to an all-time high of \$61.7 million from \$49.8 million in 1955. Expenses rose from \$50.3 million in 1955 to \$66.5 million last year.

The airline added 46 Viscounts to its fleet during 1956 to bring the number of turboprops in operation to 57.

Newport News York Chicago service was inaugurated during the year and

flights between the two points via Buffalo were introduced as the result of Civil Aeronautics Board route awards late in 1955.

Service on the airline's southern routes was expanded following the hiring of certain operating stations by the CAB.

## Management Promotions

Capital announced 13 management-level promotions to a sizable step in its overall expansion program.

- **Heen Dever**, named executive vice president and director of public relations.
- **Walter Smith**, appointed assistant to the president and director of public relations.

• **James R. Kunkel**, named assistant to the president and director of public relations. Previous title was assistant to the president.

• **Nelson B. Fry**, appointed assistant vice president of flight and George Westbrook, director of sales. Both previously held the title of assistant to the vice president and sales.

• **Joel Elowitz**, promoted to assistant vice president of advertising from director of advertising. James W. Austin will

continue to head the department as vice president-traffic and sales.

• **R. W. Hensley**, named assistant vice president operations from operations manager.

• **Earl Korman**, appointed director of maintenance from maintenance manager.

• **Stuart B. Goldberger**, named, controller and assistant vice president in charge of financial control.

• **S. T. McAlister**, appointed assistant vice president of operations under Robert Wilson, vice president-personnel and properties.

• **R. M. Averb**, named director of personnel from executive assistant to the president.

## Canadian Pacific Wins Montreal-Lisbon Route

Ottawa—Canadian Pacific Airlines plans service to Lisbon in June and to Madrid later under new authority granted last week by the Canadian government. CPA will use DC-6Bs on both on the route and probable Britannia at a later date.

Ministry of Transport's action in granting the new route was designed to increase competition for the government, that of lack of competition on routes now flown by government-owned Trans Canada Airlines.

U. S. diplomats in Canada had expected the action (AWF Feb. 13 p. 158), but it came sooner than expected.

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## Eastern Plans Idlewild Terminal

Passenger terminal planned by Eastern Air Lines at New York International Airport is shown in rendering above. Opening in 1955 would 25-acre site in Port of New York Authority's "Terminal City" at Idlewild. Other airlines which have leased areas for individual terminals at the airport are United, American and Pan American. Eastern's site can accommodate 16-gate terminal.

## Pacific Case Enters Final Phase; PanAm, Northwest Argue Routes

Washington—Long standing dispute between Pan American World Airways and Northwest Coast Airlines over opening rights across the Pacific is nearing a climax.

On arguments in two separate, but economically related, cases have been presented to the Civil Aeronautics Board.

Two cases are at stake in the current proceedings. In the so-called Transpacific Renewal Case, Pan American is seeking authority to fly the Coast Circle route from Chicago to Tokyo with traffic rights at Portland and Seattle.

The route from Seattle and Portland to Tokyo is now operated by Northwest under a temporary certificate. The second case involves Northwest's application for a permanent certificate on its Great route.

### Executive's Recommendations

Both the Board counsel and executive have recommended that Pan American be granted authority to use the Coast Circle route but without traffic rights at Seattle and Portland. They also recommended that Northwest be granted a permanent certificate on its Great route.

The cases were originally decided by the CAB in the Transpacific Renewal Case of 1954. At that time, the Board recommended that Pan American's application to use the Coast Circle route be denied and that Northwest's authority be made permanent.

President Eisenhower, however, asked the CAB to review its order and extend Northwest's temporary certificate for a period of seven years. He withdrew a decision on Pan American's application until early 1955 when it was returned to the Board for a report on new developments.

The Board last ordered that the so-called hearing on Pan American's application and Northwest's application for a permanent certificate be consolidated. It later reversed itself at the request of the White House and set both cases for separate hearings.

Presently, its recommendations in both cases will be sent to the White House simultaneously.

### 'Full Competition'

Throughout the case and during arguments, Pan American has urged that it be allowed to operate over the Coast Circle route to provide "full and fair competition" between the U.S. and the Great.

Henry F. Ford, Pan American vice president and general counsel, and the airline's parent route to Tokyo over the central Pacific is common and plans Pan American at a competitive disadvantage and disadvantageous to passengers. Northwest's attorney, William C. Best, countered, in turn, that Pan American already carries the bulk of traffic over the Coast Pacific and that, if Pan American receives authority to also operate over the North Pacific, it would place Northwest back on a level.

Representing Northwest is the Permanent Commission Case, Attorney C. Edward Lonsdale argued that the airline was denied permanent operating rights by the President because "North-

west was prevented to require authority for its international operations. However, a later developed that Northwest has conducted its international operations without authority since Jan. 1, 1955, and, therefore, is entitled to a permanent certificate."

### Permanent Rights

Pan American and Pan American would not oppose a permanent certificate for Northwest providing Pan American also receives permanent operating rights over the Coast Circle route.

The controversy over Transpacific routes began in 1946 when the CAB suspended Pan American from Hawaii to Tokyo and granted Northwest authority to operate over the Coast Circle route, both on a temporary basis.

## Air Travel Increase Of 12-17% Forecast

Wash., N. Y.—U. S. air travel will reach 415 billion passenger-miles in 1965, according to Dr. T. P. Wright, president of Cornell Aeronautical Laboratory.

Domestic traffic will increase 12% yearly through 1960 and another 17% yearly through 1965, he forecast. U. S. international air travel during the period will rise 15% and 17% respectively. World air travel will increase 15% and 17% the latter Civil Aeronautics Administration said.

In his lecture to Cornell's Graduate School of Aeronautical Engineering, Dr. Wright also forecast the total possibility of 1,500 mph aircraft, jet engines and nuclear commercial powerplants, all by 1975.

He predicted a need for vertical take-off or hover aircraft, airports for various types of traffic and specialized cargo aircraft.

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James Beattie, Washington, D.C.

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## New York Authority May Include Caravels Under Jet Noise Ban

New York's Jet Aviation would like to bring its Caravels back to transport into New York International Airport during a slow time starting next month, but the Port of New York Authority hasn't made up its mind whether to grant permission. Under FNYA regulations, takeoffs at present noise levels are prohibited near parts of the airport's New York field.

John R. Wiley, director of aviation for FNYA, and the decision will depend on how the Port Authority reacts to the Port Authority's request that an airplane's noise level be "tolerable" to airport neighbors. The Boeing 707 in its present form is not considered tolerable by the agency. Rising fuel use reported permission to land in TFW to 11,000 ft was then issued down.

**Information Gathered**  
Port Authority has asked Jet Aviation to provide data on the Caravelle upon which the decision may be based. Also, Port Authority engineers must check out the plane's external noise characteristics at least once again after the plane gets to this country. Jet Aviation has requested information to be brought to the Port Authority that the Caravelle will be made available as follows: If it isn't, Jet Aviation expects the school to have little or no effect on the side line. Noise Watcher Airport has issued a standing invitation to the Caravelle manufacturer, and Republic Aviation would make its Long Island facility available.

FNYA holds the public position of book in 1955 after Pan American agreed the first American jet under for flying 707s. The airline said each jet in the 707 was available at their present noise level.

### Suppression Program

Wiley and manufacturers are working on noise suppression although at all times "we have nothing concrete to go to." Even if built in suppression don't show up in production jets flown by the airline, flight procedures may be worked out to cut their noise to acceptable levels near the airports, Wiley said.

Aircraft noise and its effect on community relations is probably a big problem to the Port Authority as to civil airport operator. The historic independent agency has been working an egg in its airport while waiting for since the construction of their airline routes at New

York. Airport in the winter of 1963-64 closed the surrounding community to the landing plane.

Since then FNYA has cooperated in studies efforts to eliminate noise by special flight procedures, personnel removal and, and the like, and has devoted considerable effort to an intense community relations program among its airport neighbors. Rumors in local groups and political associations have been considered for years.

What would happen if continued jet noise were not cut? Would New York not really cut down the number of transport services? Wiley was so effect that the Port Authority will meet the problem of it when it materializes. He points out that the jet noise and its impact on the New York area would make it likely some solution would be found by the airline.

## PanAm Accused of Restraining Panagra

Washington—W. R. Gertz & Co. has accused Pan American World Airways of unlawfully restricting the growth of Pan American-Globe Airline and has asked Civil Aeronautics Board to extend Panagra's routes to the continental United States. Gertz's petition, filed in behalf of itself and Panagra, also urges CAB to prohibit Pan American from attempts to stockpile in Panagra to prevent effective competition at air routes the board might grant Pan American and Gertz says Panagra equally between them. The petition claims that the airline's board of directors right fourteen on a Panagra management proposal Jan. 10 that its officers be authorized to petition CAB for route extensions. All four Pan American directors, according to Gertz, voted against the extension.

## Sabena Helicopter Service to Start

Helicopter service between downtown Brussels and downtown Paris was scheduled to start this week with daily \$50 fares. For details, Belgium World Air News (AWN) Box 25 p. 37.

Sabena scheduled a once flight at its first of flight of the 12-passenger helicopter to inaugurate the new service. Time between After New Helicopters, Rome, and Sabena Helicopters, Paris, is a 10-hour and a half.

Routes sought in the petition included from Dallas to New York and Washington via Miami, and from Dallas to Los Angeles and San Francisco via Mexico City. Panagra can often receive priority, Sabena said, but only by getting its own routes into the U.S. Gertz contends.

Pan American's own long-haul route to Mexico City is competitive with Panagra's route from Dallas to Mexico City. The petition notes, and Pan American's petition efforts to restrict competition from Panagra stem from a policy, and its attitude toward Panagra which has been open and courteous.

Panagra's route mileage has shrunk in other international routes have been expanding their routes, the Gertz petition claims.

## SHORTLINES

United Airlines opened 1490 million passengers in January, up 6% from same month of 1956. Air freight total was up 35% for the month to 14 million tons, and up 10% for the year to date 15% under January, 1956.

National Airlines said 1957 most pickup ton in Florida with the Caribbean from coast first month of 1957 season, Dec. 15 through Jan. 15. Rise is by and drive business is indicated by 25% increase in rental car bookings, and extension trip to Havana and Mexico have risen 50%.

Overnight New York-Miami special is being operated daily by American Airlines and Pan American World Airways, with American's leaving Miami on a meeting at Los Angeles with Pan American. Roundtrip that runs for a \$411.10. Cash-in-hand combination by the two carriers provides New York-Miami service for \$419 roundtrip.

Canadian Pacific Airlines has been licensed by Canadian Air Transport Board to extend its North American service to Santiago, Chile. CPA will fly from Vancouver to Toronto to Mexico City, then there via Lima, Peru, to Santiago, and then to Buenos Aires.

Wien Airport between Bonn and Cologne in Germany will be transferred to civil administration Feb. 1. Field projects it used by Royal Air Force will land at an industrial field. Facilities will be established at Witten by the German government.

New \$112 million passenger terminal at Sabena, Southern Rhodesia has opened this week and operations moved from freight hangar. The \$175

# PLANE FAX

by STANDARD OIL COMPANY OF CALIFORNIA



## Herding hungry ducks by air

Twisting back and forth above the two fields in Gilroy, Calif.'s San Joaquin Valley, Frank Gallini drives herding ducks out of the grain and toward surrounding game refuges and grasslands. Before he started this herding, farmers in the area often lost half a coop or a single day to migrating ducks.

One of the most experienced fliers in the West, Mr. Gallini has been logging 20-300 hours, mostly in low flying farm work. "Making turns 30 feet above muddy rice fields adds few plenty of extra powers," he says. "I always get it with

Chevron Aviation Gasoline, even on hot days when the engine is trying. It burns clean, too, never fouls plugs. I've used Chevron in all my light planes ever since a new one.

"And in spite of the tough flying I do, I've never had an gas trouble since I started using RPM Aviation Oil. I've gone 1200, 1300, even 1600 hours between overhauls, and I take them down just because of the hours. RPM holds down down to next to nothing, keeps the rings and valves in clean as new. I wouldn't use anything else."

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Another reason why G.E.'s newest turbojet

makes possible the ideal medium-range jetliner

## General Electric CJ-805 Backed By World-Wide Jet Service Network

When you specify the General Electric CJ-805 for your jet transports, you will receive jet service second-to-none, wherever needed. General Electric's support organization will provide:

### THE WORLD'S MOST EXPERIENCED JET FIELD SERVICE ENGINEERING GROUP

- to help set up your CJ-805 maintenance program
- to assist in operational and maintenance problems
- to provide on-the-spot factory knowledge during jet transport phase-in periods

For its military engines, G.E. has more than 250 jet techs in the field.

### COMPLETE JET ENGINE TRAINING FACILITIES

- classes at your base or at General Electric's Evendale, Ohio jet plant
- basic jet engine familiarization courses
- advanced CJ-805 classes in assembly, disassembly, operation, maintenance and overhaul

### THE WORLD'S MOST EXPERIENCED JET GROUND SUPPORT ORGANIZATION

- to help determine your needs for tooling, test and handling equipment
- to help program your spare parts needs
- to help you have the right ground support items at the right base, in the right quantity

For more information on what the CJ-805 offers your high-capacity transports, contact your G.E. Aircraft Engine Specialist. You can reach him via your nearest G.E. Aviation & Defense Industries Sales Office. General Electric Company, Cincinnati 48, Ohio.

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**LESS OF MAINTENANCE** is key feature of General Electric CJ-805 turbojet. Based on J43 experience, the CJ-805 will require only 158 man-hours to overhaul only 3 man-hours line maintenance per engine flying hour. The CJ-805 will begin service in TWA and Delta Air Lines' new fleet of Convair 440's.



**G-E COMPONENT DEVELOPMENT CENTER** near Cincinnati is one of the most advanced jet facilities in the world. New materials and principles for advanced jet propulsion systems developed in these facilities are now being incorporated into CJ-805 design.



**COMPREHENSIVE PRESENTATION** on why the CJ-805 makes possible the ideal medium-range jetliner is available to qualified airlines. To arrange a showing for your engineering or management staffs, contact your nearest G.E. Aircraft Engine Specialist.

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**







## Beckman Servomotor- Rate Generator

Bring in two legs in their twisted attitude and housing, motor and generator work hand-in-hand on the same shaft...to improve response characteristics of differing servo systems.

Where the trouble is in the dynamics of your system components, with this purposeful pair and your clever and go to work. The high torque-to-inertia motor, for instance, responds quickly and accurately to error signals...with acceleration at stall up to 300,000 rad/sec<sup>2</sup>. Signal-to-noise ratio of the latest generator is 250:1 or better. And its speed and starting characteristics are fine-tuned exactly, they'll operate continuously at stall and at speed until temperature from -55°C to 200°C.

High speed, low vibration response, completely encapsulated. Servomotor-Rate Generators are available in sizes 11, 15 and 18. (We'll soon add size 10 eventually, other sizes.) We've got descriptive literature and field too. It's the file 338.

**Beckman**  
**Helipot**  
Corporation  
Menlo Park, California  
a division of Burroughs Instruments, Inc.  
Engineering representative  
in your area

radial motion. This is possible because the temperature of an object determines the wavelengths at which its infrared radiation occurs. Thus the radiation from a pit sniper's target occurs principally at a wave length of about two to four microns while that from the cooler pitbox engine occurs at about eight microns. (A wave is equal to one millionth of a meter and is a convenient term for the infrared region because of its very short wavelengths. Thus three microns correspond to a frequency of about 100 million wavelengths.)

The Air Force recently conducted tests atop Pike's Peak in Colorado to determine the infrared spectral emission characteristics of a number of different types of pitbox and jet engines. The resulting data permitted measurement under high altitude conditions such as might be encountered by an infrared guided missile.

### IR Fingerprinting

A device which can be used for infrared fingerprinting is the airborne infrared manometer, developed by Seno Corporation. It measures wavelength and intensity of infrared radiation. Manometers have been purchased by the USAF and French Air Ministry. A somewhat similar device made by Beckman is being used by Boeing to check the spectral emission characteristics of various metals and high temperature resistant coatings at temperatures up to 1,400° Fahrenheit.

Nature seldom provides advantages without attendant disadvantages and infrared is no exception. Shortcomings of IR for military use include:

- No distance measurement. Infrared radiation ceases after target radiation, called "jacket radiation," have no direct means of measuring distance to the target—information which could be obtained by measuring the time required to bounce it off the target. The missile application is to the side-looker, this is no serious handicap. It is when IR is used for the forward seeker that this becomes a serious handicap. The main reason for this is that the beam is so wide. A seeker technique similar to that employed on a TV set comes with conical coverage. This requires the use of two infrared tracking heads physically displaced from one another. Range is determined from the angle between the lines of sight to the two trackers. Another approach, called stereoscopic ranging, measures the angle subtended by the capsize of a missile engine, also assuming that the distance separating them is known.

- Atmospheric and weather attenuation. Although high frequency radar suffers some attenuation of signal strength from weather and oxygen in



**DEFENSE**, which converts infrared radiation into electrical signals, is heart of all infrared systems.

the air, infrared suffers far greater signal loss below 30-40,000 ft. except in certain parts of the spectrum called "windows." Systems designed for use at lower altitudes normally operate at wavelengths that fall within these infrared windows where possible. Many can and may further limit infrared range, albeit at severely as they do human vision.

- Radiation environment. The fact that every object radiates infrared, previously cited as an advantage, is a serious disadvantage when IR is used for missile guidance, detection, or fire control. Infrared energy from the sun, for instance, reflected from a hot-charging cloud formation might lead an infrared guided missile when it is just engaged target. Perhaps the most difficult part of infrared guidance system design is to control it with the ability to discriminate between infrared radiation from the target it seeks and that from nearby objects. At least one infrared guided missile program has floundered on this and

### Infrared Heat Now

Many of the latest generations of infrared heat-seeking missiles. For instance, shortly after World War II Coastal Electronic was experimenting with infrared for search detection and was able to spot a light bomber at distances out to 22 mi under favorable



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weather conditions. GB's sophisticated IR beam for vast concentrations of detection of some 100 to 1000. But then GB shifted its attention to radar detection, or rather, as it is now called.

Really, the great technological breakthrough of the late 1950s and early 1960s, turned military and maritime about-face from infrared, except in Germany. During the war the Germans, and later the U.S. and Britain, devoted their major infrared efforts to "active" advanced reconnaissance systems, headed by the "superbug" Thales' converted at an infrared light source to illuminate the target at night, without the latter's knowledge, and an optical sensor which converted the reflected infrared into visible light enabling an observer to see his target. These types of active systems normally operate in the near infrared region, at wavelengths shorter than approximately 1.5 microns.

### German Use

The Germans employed infrared detection against Allied night bombers to supplement radar and to counter Allied dual which contained German radar.

The Germans also experimented with IR for subsea detection and developed an infrared viewing system for the Wiesbaden anti-aircraft missile.

Although the Allies possibly lagged behind the Germans in infrared work, there was a handful of advanced projects whose development was not delayed by the development of radar. Infrared guidance was applied experimentally to several glide bombs, finally got into limited production in a five-inch bomb called Fido which saw service in the China Burma India theatre shortly before the war ended.

Of the many missile study development contracts awarded after the end of the war, most contractors turned to radar for infrared guidance with only a few exploring the possibilities of infrared.

Infrared search of some vehicles, support for applications to ranging and surveillance, but in the field of ground based detection of aircraft, radar has ruled unchallenged—until recently.

### Fire Detection

Before the advent of the Superbug, the most published application of infrared in aviation was its use in the detection of fires and smoke clouds to detect an incipient explosion in a fuel tank.

The advent of the jet airplane and rocket-propelled missile operating at high altitudes speeds up the explanation that make excellent IR targets and the increasing cost and difficulty of obtaining any further increases in engine size are perhaps responsible for the

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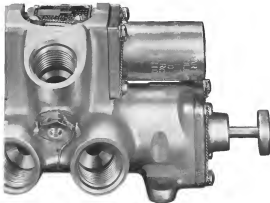
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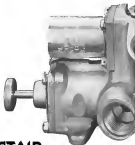
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portions of the spectrum is actually 12 times higher.

Translating this into effective range of detection, when range is proper based to the square root of resolution velocity, means that a Mach 2.4 vehicle theoretically could be detected at five to six times the range of a Mach 0.5 vehicle based on their respective skin temperatures. (This neglects the effect of actual detection conditions and atmospheric refraction variations as different portions of the spectrum objects to be avoided later.)

Where a 100% increase in a vehicle's speed from Mach 0.5 to Mach 2.4 would result in a proportional reduction in radar range, assumed to be one of time, it could produce a 400-500% increase in range for a infrared detection system.

#### Infrared Restrictions

There are some of the factors which make infrared systems so attractive for missile guidance, fire control and target detection.

Where the radar designer has comparative freedom to select an operating frequency which will optimize the equipment performance for its intended application, the IR system designer is more handicapped by nature.

He has no control over the frequency at which the target's peak radiation occurs, because that is determined by target temperature. Thus he cannot shift frequency to match the radar designer to avoid those portions of the spectrum that heavily absorb infrared energy.

Nor can he boost power to compensate for this attenuation in the radar designer's case.

The IR vision requires on each man-made IR infrared receiver design a combination of optical, mechanical and electronic elements. Two of the most important of these elements are the infrared detector which converts the low-level infrared energy into a usable electrical signal, and the optics which must collect a maximum amount of the available infrared energy.

Infrared detection, optics, and active design considerations will be the subject of the second article next week in *Aerojet*. Watch the special report on infrared.

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## AERONAUTICAL ENGINEERING

### Oversecrecy Defeats Itself, Scientist Says

By Louis N. Ridenour

We can distinguish three main components in the flow of technical and military information: first, the intercommunication of such information within industrial and governmental groups which are directly involved in design, related work, research, the flow of such information to the U.S. public at large, and third, its transmission to potential enemies of the U.S.

The aim of security restrictions imposed on information flow is to deny information of consequence to our potential enemies—which usually entails denying it to the public generally—while at the same time exposing to little detriment or even to the destruction of this information among those who are judged to have a need to know it.

#### Usual Channels

Because the generally established channels for publishing information do not permit distinctions in the treatment accorded the three groups mentioned above, the usual publication channels are not generally used for classified information.

Not officially, that is—the enemy and repository of the accumulated trade secrets in this and other countries have on some occasions encountered difficulties in communication which have been ascribed to the nature of secrecy.

At all events, the flow of accumulated information is continuously interrupted in the name of security. The true goal of any restriction in the

normal pattern of information flow is enhancement of our national security. The use of the word "secrets" to describe restrictions on the flow of information has a tendency to obscure this point, since in other connections "security" is a synonym for "safety." It is not necessarily synonymous with "safety" in the present connection, and this must be remembered at all times.

#### Two Categories

Generally speaking, there are two main categories of accumulated information which are subjected to security classification. These relate, on the one hand, to existing military capability and, on the other, to research and development work, which is weak, significant in terms of future military capability.

In times of normal peace, such as

#### Dr. Louis N. Ridenour

The discussion regarding on this page on how secrecy impedes technological progress was given in Washington at the Second National Jet Age Conference of the Air Force Association. Dr. Louis N. Ridenour, World War II Radar Expert, is now director of research and development of the Missile System Division of Lockheed Aircraft Corp.

Dr. Ridenour represented the aircraft industry in a program on the general subject of "The Flow of Information." Other speakers were:

- Philip K. Allen, Deputy Assistant Secretary for Public Affairs of the Department of Defense, who defended the present security system.
- John Moss, (D-Calif.) chairman of the House Subcommittee on Government Information, who discussed the current strengthening of Defense Department policies.
- John E. Hull, retired U.S. Army general, member of the Senate Committee on Civilian Information, who described the work of that group.

we now enjoy, our national military establishment has as its main concern value its deterrent effect on possible hostile actions of other nations. The supposed capability of this military establishment is presumably very carefully weighed when another nation is deciding whether or not to take steps aimed at our best interests. The deterrent effect of the Strategic Air Command has often been cited as the main shield of peace in the postwar world. Our preoccupation with the development of long-range ballistic missiles has in its goal the strengthening and improvement of our deterrent capability.

To have any deterrent effect, a military establishment must actually communicate to potential hostile nations its approximate capabilities and extent of battle. Otherwise, there total co-



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problems will not be taken into account when other nations decide on future courses of action. Thus we have the paradox that a genuinely correct weapon is absolutely worthless in present time.

All this is well known to our critics, leaders, of course. The recent speech, ending right around the middle, by E. S. of the Strategic Air Command was simply a demonstration of the capability of our free-thinking, and was well contrasted to demonstrate our global situation. Even Unfortunally, however, the people a sometimes lost sight of in the course due to the ignorance of the flow of information in America. Surely, a sometimes, as pointed in a voice in and of itself, as depicted of the people that a semi-voice has no value.

### Real Secrets

Sometimes, the happen because there is a category of information or perhaps current military capability that generally need be kept as secret as possible. I refer to the information which, while having little to do with the defense itself, could be used to tell potential enemies about it, of such a nature that its knowledge by a potential enemy would simply be a tactical offense, by giving him insight for effective countermeasures. A good example is the precise communications methods planned for use by the Navy or the Strategic Air Command. If these were known, perhaps by an enemy, he could prepare himself to disrupt such communications at a time of his choosing, with potentially disastrous results. Another example is the related speaking doctrine of such a nature. Knowledge of this could greatly simplify defense.

Even with respect to such vital bits of information as these just discussed, it is worth noting that something no equivalent is still not the optimum policy. The theory of games developed by the late John von Neumann is able to prove conclusively that a more strategic move, namely, not telling the truth is preferable to any final strategy such as that of attempting solutions on confidence, in any relation such as the one obtaining here.

### When Security Strides

The chief of security represents on the flow of technical and scientific information, mainly related to future military exploits. Even without any inspection or restriction imposed on information that is the result of research, great difficulties can be encountered effective communications.

The vast growth of our research establishment and consequent requirement for an increase in the numbers of scientific communications have not

been met by the classical medium of technical communications—the special period. Publication delays of a year or more are common, and even the theoretical editing and reviewing are inadequate.

Even though publication is lagging, the individual technical reader's task of keeping up with the literature is becoming ever more difficult. An important part of this difficulty is the growing bulk and significance of the Russian technical literature, which very few of our people are able to read. At the same time, the inadequate but still substantial growth of our own technical literature has placed severe financial demands on our technical society, inevitably the sponsor of scientific and technical journals.

Thus, quite apart from security restrictions, our scientific and technical communities are having great trouble in maintaining sufficient contact with one another. This is a matter of deep present concern. Experts in documentation are deeply seeking ways in which communications can be improved. One recent effort of this sort was a conference held at York on Remote Viewing, in January, 1958, on "The Practical Utilization of Knowledge—Present and Future." It is interesting in the present context to note that some of the sessions of this conference were held in kind closed doors and that the full names of these "confidential" sessions was never published.

### Aid to Progress

The huge strains for securing prompt and effective dissemination of the fruits of scientific and technical work, in that further rapid progress will thus be facilitated. When consideration of scientific work is considered in the same of accuracy, it can also be recognized that the effect of such consideration will be felt both in our own development community and as that of our potential enemies. If our total technical competence is greater than his, then on balance we shall have no problem in suppressing the free publication of technical information.

A good example is afforded by the Radiation Laboratory series of 27 booklets and volumes describing the work done during World War II on radio and microwave electronics. This series was dedicated to the proposition that the \$500 in more technical work was spent on wartime radar development should not have a transition value lost, instead, should be protected as a basic for future work. The analysis books, which appeared in the years 1947-1951, have sold very readily, both here and abroad. I have often heard them criticized by people who claim that we have "made a profit" in Russia of everything we



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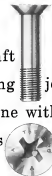
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learned, by taking as much effort as this superior field.

In my own opinion, this note completely overlooks the fact that we also made mistakes, a percent of the number of this work. And I think that no one can deny that we have made better out of this information than the Russians have done. Our advanced electronic program is rapid and exciting, there has been no secret slave and mass per factory.

### Nuclear Jet

The field in which Russia has gone on our biggest secret surprise is that of nuclear power. They displayed a three-stage device for energy that they could have done in one stage. It is a fact that the Gromov conference on the peaceful use of atomic energy, they showed us a secret device by the name of the "Gromov" and discussed. And this is a field in which we had been most cautious about publication.

Then it is clear from the record that the technical activity of Russian scientists, far more than our own policies regarding the publication of information of technical information, have exposed the entire factor governing their progress. At the same time, our own progress was being slowed whenever we suspected or restricted publication of

the results of our work in the past. In the interests of security by achievement, as opposed to security by concealment, we should probably encourage our scientists and promptly and effectively in our own results of our scientific research and development program. To do this is to combat the one total development capability in science in that of our potential enemies.

In deciding who should have access to information handled under security restrictions, much is made of determining whether or not a proposed recipient has a "need to know." The information is a meaningful concept with respect to the sort of professional information that we have already noted must be closely held in the national interest.

It is far less meaningful in respect of engineering information. It is entirely without meaning in respect of highly creative engineering work or scientific research.

For a scientific officer to assert that such a man as Edward Teller does as does not have the need to know of the results of the scientific work of another man in his field is ludicrous and absurd. Teller, being a theoretical physicist, is engaged in improving our current understanding of natural phenomena. I am sure he has better the first, no way of judging whether or not

the work of another man will help him in doing this. I am perfectly sure that an atomic officer could know, if he could, he could presumably replace Teller in a physical, once he knows what Teller will not discuss.

Even though we can see that the concept of the "need to know" is not as meaningful as the withholding of fundamental science, still we must appreciate the prohibition for the concern of security people with even the most advanced scientific work. This concern springs from the historic unparalleled good with which fundamental scientific discovery is translated into practical engineering applications.

### Time Space

Had a century elapsed between the discovery of electromagnetic induction, which made the electrical power industry possible, and the birth of the radio, 100 years later, a quarter of a century ago, the discovery of radio waves by Hertz from the accessible day in which Marconi transmitted the letter "E" across the Atlantic Ocean. Only one year went by between the discovery of nuclear fission, which made atomic bombs conceivable, and the Trinity explosion in New Mexico.

This practical effect, including military purposes, are likely to be far more broadly affected and very possibly—

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by sciences made in fundamental science.

Therefore, so much as we may desire the remodeling of scientific efforts into scientific efforts, however suggestive we know it to be, still we should appreciate the reason which motivates this concern. The responsible task which the leaders of scientific institutions have undertaken is nevertheless one which, if achievable, is it is not-would be desirable.

#### **Benefits of Research**

Finally, we come to the obvious point that the results of the various research and development programs are really supported by military insights are of the greatest possible use in developing the powerful concerns. A direct and immediate example of this is afforded by commercial air transportation, whose growth and development constitutes one of the major technical pleasures of our age. It is not only to attribute a major part of the technical advances in our air transport capability to commercial development sponsored and paid for by the military services.

These benefits to commercial aviation from military development work

have come about only because of the freely release from security restrictions of the pertinent technical information. This illustrates how the general peace time concerns can benefit from technical development first made with military requirements in mind. Whenever the declassification and release of such work is advisable from the military standpoint, there is no doubt of its desirability from the social point of view.

There is evidence that competent agencies of the Department of Defense are aware of the dangers which result in the retrogression of technical information interchange. However, I have sometimes encountered far more subtle that the suppression of information is beneficial and worthwhile for its own sake.

#### **What Should Be Done**

This, as I am sure we can all agree, is far from the case. We have seen that:

- Information on present military capability must reach the potential enemy to give the military capability, and posture value.
- Certain classes of operational information must be most carefully safe-

guarded. These are defined by the strategic and tactical requirements of the present technical information that this was allowed.

- Even with respect to such sensitive information, something suppression does not afford the best comprehension.
- Scientific information is being grasped only with difficulty, even grasping the effort to expose classification upon it.
- Suppression of technical information will benefit as only if our development capability is inferior to that of other nations.

- There is no such thing as a harmless bit of information of "need to know" in any scientific field.
- The desire to regulate scientific communication understandably springs from the present unscientific connection between science and technology.
- When military considerations permit, the free release of technical information is clearly in the public interest.

This last point is true not merely because powerful technology and military technology are closely related—though they are.

It is also true because a democracy can choose one course of action only when the people generally are adequately informed.



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Largest Airplane Yet Made in Canada

16-B equipped Canada CL-28 airplanes are to be used for mail/cargo service by the  
ROYAL CANADIAN AIR FORCE



**PB-20D**

Automatic Flight Control Systems

selected for **BOEING 707**

America's First Commercial Jet Airline

16-B equipped Boeing 707 airplanes are scheduled for service on routes of these airlines

AIR TRANSIT • AIR INDIA INTERNATIONAL • AMERICAN AIRLINES • BRANIFF INTERNATIONAL AIRWAYS  
• CONTINENTAL AIR LINES • GUTHRIE AIRLINES • PAN AMERICAN WORLD AIRWAYS, INC.  
• QANTAS IMPERIAL AIRWAYS, LTD. • SARINA BELGIAN WORLD AIRLINES • TRANS WORLD AIRLINES



Bendix Avionics  
Automatic Flight Control Systems



**PB-20E**

Automatic Flight Control Systems

selected for **LOCKHEED ELECTRA**

first American-made Commercial Turboprop Aircraft

16 PB-20 equipment installed. Both airplanes are selected for service on routes of these airlines:  
 AMERICAN AIRLINES • BRANIFF INTERNATIONAL AIRWAYS • EASTERN AIR LINES  
 KLM ROYAL DUTCH AIRLINES • NATIONAL AIRLINES • WESTERN AIRLINES

*Eclipse Pioneer*  
 DIVISION OF BENDIS AVIATION CORPORATION



**PB-20F**

Automatic Flight Control System

selected for test and evaluation on **CS2F-1 TRACKER**

Carrier based, Anti-submarine Airplane

Built by DeLaval Aircraft of Canada, Ltd., for the  
**ROYAL CANADIAN NAVY**



*Eclipse Pioneer*  
 DIVISION OF BENDIS AVIATION CORPORATION



## Automatic Flight Control Systems

Manual power controls • Autopilot system • Control net cable system

**selected for CONVAIR B-58 HUSTLER**  
America's first Supersonic Bomber

Conquest B-58 Hustler in-flight air weapons systems are in use by the  
UNITED STATES AIR FORCE

APR 1965 11 31

CHIEF-DESIGNER AUTON CORPORATION

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AMES AERONAUTICAL LABORATORY will use this 120-ton airfoil mold to produce smooth, 10-ton sculpture curved shape of metal or composite blade in steel as it is being to vertically held piece of center. Daily Machine Specialties is maker.

## Mill Sculptures Airfoil Shapes

AMES Aeronautical Laboratory, Moffett Field, Calif., has installed and is operating a milling machine capable of turning out complex curved airfoil shapes and turbine blades from blanks 15x16x60 in. for testing and use in the laboratory's supersonic wind tunnels.

The miller was designed and built for Ames by Daily Machine Specialties, Inc., Chicago.

The machine turns pattern blocks of size and shape identical to the desired final piece. Pattern blocks are held in place hydraulically, and the mechanism holding the blank can turn an upward thrust of 1,500 lb. Each pattern block and blank are held in place in the vertical instead of the usual horizontal position to eliminate any possible bending from the weight of the blank.

Two towers which follow the pattern, transmitting the desired contours to two diamond-like heated cutting heads. Both pieces and blank, available at the same speed to move through shapers. Finished parts can be held to tolerances of plus or minus .004 in. Cutting speed

ranges from a low of 75 fpm. for high alloy steels to a high of 3,148 fpm. for soft aluminum alloy.

Cost of the machine was \$564,000, including design. The fully automatic machine covers more than 640 sq. ft. of floor space, and uses 17 electric motors to drive all components. Reissner Electric and Engineering Co., Cleveland designed the machine.

## GE Creates Industrial Diamond Substitute

A 3,500°F industrial substitute for diamonds, which vaporizes only at 1,600°F, has been created by General Electric's General Laboratory, Schenectady.

Laboratory director, Dr. Gus Itoh, considers the compound material which GE calls Borsene after its two constituents, Boron and Neutron, as a potential substitute for diamond dust in industrial hard material grinding and a possible replacement for high temperature dry point bearings.

Dr. Itoh also considers the new ma-

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AVIATION WEEK, March 6, 1965

77

This untouched photograph shows the Lear Miniature Rate Gyro shipped to a jackhammer, riding side-saddle through two hours of pneumatic nightmare. After this "shakedown run" the gyro still performed up to the most exacting specifications set for the newest Air Force, Navy and Army missiles. This gyro is available right now. How many do you need?

LEARN  
MINIATURE  
RATE  
GYRO



tial as an example of what can be expected from type-persona research. The discovery, he says, is a classic example of how a scientist merges broad knowledge with luck in making a fundamental discovery.

Bogger's discovery started when the similarity between graphite, which is diamond in the non-crystalline form, and "white graphite" or hexagonal boron nitride, was noted by the lab's then Dr. Robert Wentorf. However, Boron nitride does not have graphite's extra electrons which permits graphite being bonded in a crystalline structure to become diamond, a transformation which GE accomplished in 1955 by using 1,300,000 psi. super pressures and 5,000°F temperatures.

But when Wintorf used 1,800,000 psi and 1,000°F and a third substance which GE did not disclose, he was able to make the tube-like bones nitride powder grow into crystals. The nitrogen atoms "donated" electrons to the bone stems which in turn and the extra electron to form another chemical bond with a nitrogen atom and all the oxygen atoms in the bone structure were

connections at the atmospheric ports were interlocked together. The resulting "cable house outside" is not only a substance unknown in nature but the first substance to have a hardness anywhere near a diamond's.

X-ray diffraction photographs further verified the similarity by showing that the Raman crystal structure was practically identical to that of diamond.

The industrial work it is expected to be superior to diamonds because it is withdrawn the higher grading temperatures of the new high temperature materials which are becoming more popular, especially in aircraft, and it will use our present dependence upon politically unstable Africa as a sole source for diamonds.

The General Laboratories policy is to hire promising scientific discoveries to CSE manufacturing divisions for exploitation.

## New Nickel Alloy Produced for Jets

A new high temperature nickel alloy expected to find use in highly stressed parts of turbojet combustors is now being produced by the International Nickel Company. Another possible use is in the nose cones and wing leading edges of transonic aircraft and marine

The new alloy is harder in composition than the manufacturer's earlier aluminum because it has a higher silicon content, but is still softer than steel. It contains about 10% titanium. It is

The alloy sheets are annealed at 1,200°-1,250° F. A good combination

of strength and formability are reported by fabricators who process around their parts at 1800-4,818°F from 20 to 16 minutes and air cool them rapidly. Tensile and rupture strengths below 1,700 can be expected by cold working but the member's adhesion against the if the part is to be welded because of the stress concentration which will form along the edge of the weld.

Corrosion tests conducted at 1,600°F for periods from 100 to 1,000 hours showed that the weight change with time was about the same as that for the alloy without titanium. In both alloys the weight change is a gain because of the tight adherence of the oxide layer.

## F-104 Crash Kills Lockheed Test Pilot

Palmdale AFB, Calif.-Lockheed test pilot Joseph W. Coyle was fatally injured in a crash of an F-401A fighter jet during a landing approach at Palmdale AFB on Feb. 15.

Chen, 32, died of injuries on the following day. Observers said he appeared to be pulling a rafting approach immediately before the supersonic Starfighter crashed.

A veteran of the Fifth Air Force during World War II, Gross joined Lockheed in 1951. He was a founder and acting secretary of the Society of Experimental Test Pilots.

## Bell HUL-1 Completes Fleet Indoctrination

Fort Worth-Bell HUL-1 utility helicopter has completed its fleet induction program test ahead of schedule and is being delivered to Navy units for Arctic service.

During the test period, HUL is quoted 74 of an hour for maintenance for each hour of flight. Bill points out that this ratio is substantially better than the average rate of three hours of maintenance for every flight hour normally found in such accelerated test practices.

General James S. Russell, chief of the Bureau of Aeronautics, praised the HUI maintenance record as a letter of commendation and said the report is most encouraging because the HUI was ordered for use in remote areas and for longer missions.

Bell is delegating the USFL to both Atlantic and Pacific coast units. Headquarters' primary mission will be ice breaking, patrol and support in the Arctic.

## DATA

ON THE NEW  
LEAR MINIATURE RATE GYRO



**compact and durable**—It has been vibrated up to 10 G's and 2000 gms. and subjected to shock up to peaks of 110 G's without significant effect.

**INVERTER, IMPULS—**Electro-magnetic pick off supplies 4 volts, 600 cps into a 10-ohm ohm load at maximum rate input. The parts of different maximum rates are

It is also available including integral demodulator in a mounting base for applications requiring a DC signal output.

**NEW HUBBARD**—Unit weighs only 1 pound, measures only 1 1/2" diameter by 1 1/2" long, yet resolution, threshold and

**MINIMUM "CROSS HAIR"**—Patented design & technique has provided previously unseen steel cross axis stiffeners. Movement & vibration axes virtually eliminated.

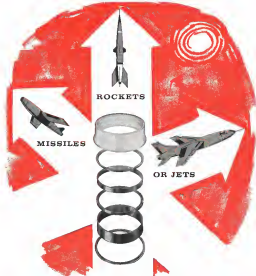
**LIN THOMAS, HILL GARY.**—Use of thermally compatible materials for all assembly parts brings about new laws in the amount of wall draft resulting from temperature changes.

**DAIMLER GANFUS**—Through selection and close control of piston and cylinder materials and damping fluid, the damping effect varies with temperature to smoothly compensate fluid viscosity variation. Damping is thus maintained at a .9% critical throughout the operating temperature range of  $-40^{\circ}\text{F}$  to  $+180^{\circ}\text{F}$  without the use of bellows.

**VERSATILITY**—Unit is available with either 36 or 125 volts, 400 cps, 3-phase or 1-phase, 400 cps, split single phase motor. Can be supplied for any maximum voltage required. Unit is readily adaptable to requirements involving different signal outputs and damping characteristics. 1 and 2 axis packages also available.

# LEAR





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## EQUIPMENT

### British Report Progress on Angle-of-Attack Instruments

London—Flight guidance instrumentation based on angle-of-attack measurement instead of speed has reached an advance stage in Britain. This development was revealed in *Aircraft Warning by its Enemies*, R. Youngman, a design consultant and one of Britain's premier aeronautical engineers. The idea sprang from his life's work with high lift and anti-stalling devices.

Using only a rudimentary computing element, the system continuously calculates the pressure ratio between two stations on the wing profile. Its relationship with speed and angle-of-attack is used in a cockpit presentation choosing the optimum angle for any flight condition.

Advantages of the system over a speed sensing device:

- Direct indication of the current angle-of-attack, without reliance to the weight constant.
- Greater response characteristics, as it senses onset of disturbance to wing circulation—not effect.

#### Limited Production

Extensive development work with straight wing model aircraft has proved highly successful and are now to be extended to swept wing machines.

A limited production is already under way, but Youngman states the system is to be standardized in all new aircraft soon. It is to be tried out in the 3 1/2-engine Canadair 7 and others, then, and according to Youngman, is already being used in flight trials with automatic landing systems.

The principal drawback of even a model speed sensor is its dependence on weight. To achieve and maintain optimum angle of attack for varying flight conditions, the weight must decrease, the speed of flight can vary, different values of lift and lift changes considerably as the fuel is consumed.

Maintenance of the optimum angle becomes critical for efficient return to descent circuit. With slight variations of altitude for each jet, density, weight, fuel and frequent speed changes, narrow (over half hour) in the Comet to meet the speed and weight selection as indicated on charts revised in the air.

Angle of attack instrumentation, by keeping speed constantly in phase with the weight, should stop changes thus, allowing the best fuel economy and reducing the drag effect.

Use of the system in model aircraft makes clock landing safer, easier and shorter. The pilot is able to approach safely at the optimum speed for the aircraft irrespective of the weight constant.

This fact together with the greater response rate means stalling margins can be reduced and approach speeds lowered.

At low aircraft load at the minimum speed dictated by the gross weight, which is consequently lighter than usual, he

#### Constant Ratio

The system owes its development to the angle fact that the ratio between pressure tap at a selected position on the wing and the stagnation pressure ( $p = p_0$ ) becomes substantially constant for a given angle of attack for all air speeds. (It neglects R. effect.)

The value of this ratio varies almost linearly with angle of attack as represented in Fig. 1 in the dimensionless ratio V/V<sub>stall</sub>, where V is aircraft speed and V<sub>stall</sub> stall speed. The relationship in Fig. 1b is more difficult to calculate.

The computing element can then be arranged to present the p/q ratio on a dial readily calibrated to read the desired optimum values for varying flight conditions.

The p/q computing element in its original application took the form shown in Fig. 2 and it was used to monitor the Barton Complex round generator which is used in its model for clock landing with the British Aerospace 100. It applied speed sensing elements, as the S. C. round generator and has a circular electronic light read at the RAF Institute of Aviation Medicine, Larkhill, and clock trials on HMS Bulwark.

Two types of equal ratio, using the p and q pressures respectively, are given a term so that their maximum, short the difference in the optimum approach speed of 1.25%. For this value the instrument is independent of changes in weight and air density and that when the beam is deflected the optical displacement electromechanical indicator a deviation error of up to 15%.

Fig. 3 shows a servo system which instead of multiplying the optical displacement, uses capacitors of different



Fig. 1a



Fig. 1b

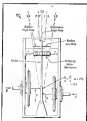


Fig. 2



Fig. 3

VALLEY STREAM, N. Y.: 108 3a, Freshwater, LD 1 4000 • SAVYTAI, GEMO, HM Commercial Bldg., AL 4543 • B. 1850Wich. Cal., 477 E. Broad Ave., SA 5-1404



Fig. 4



Fig. 3

effective piston area arranged so that cyclic restraint is nil at the upstream valve of the pressure ratio. A servo valve follows up the cycloidal displacement by movement of a screw, its angle of displacement being used to operate the valves. One original version is shown in Fig. 4.

The latest data now derived for the general development is shown diagrammatically in Fig. 5. It determines the percentage area over the whole possible flight range and can therefore be used to determine the angle of attack under all flight conditions.

Two capsules are connected on a frame of right angles to each other. Links run from the capsules to a point where they meet a third link which is vertical about the pivot. If the capsules are of equal size then  $\tan \theta = p/q$ . A servo mechanism is arranged to swing the first link in that ratio one and two capsules respectively thereby ensuring

## Aerophysics Designs Rotating Balancer

A simple vertical balancing system capable of dynamic balancing of large rotating elements such as spin stabilized rocket motors, rotating launchers, heavy flywheels and turbines has been designed by Aerophysics Development Corp. Rocket motors may be tested while firing. The unit is capable of

Units weighing several hundred pounds have been hauled to an area of about one-half acre of a field. The test and correction procedure took about an hour.

With minor changes in the suspension system, the test stand may be adapted for measuring jet misalignment of rocket motors generating from 300 to 20,000 lb thrust. Five of the stands are now in use.

1. No person charge for warehousing service.
2. No established minimum on orders.
3. The amount ordered is delivered (no plan or minor 40%).
4. Highest security inspection standards maintained.
5. Single lot future scheduled orders in field (no future delivery date and availability for earlier shipment if needed).

7. If item required is not in stock, delivery is same as well — and, therefore, stock will be maintained for future shipments.

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## PIONEER

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AVIATION WEEK, March 4, 1957

**Subzero Factors to Consider in Miniature Bearing Application**

**TYPE OF BEARING**

The ball-bearing fitted with the contact covers retains its full support for the great majority of instrument applications. Even ball spacing permits good performance at low-temperature speeds, and it can also handle moderate thrust loads. Improved lubricating techniques permit its even retention being specified for low-temperature demands.

Plastic Bearings machined from plastic plastic when higher speeds are also possible, some retention of lubrication. This retention is used with regular standard bearings which are used in ground away from the case or actual time to permit bearing assembly. Such a design permits thrust only in the direction of the side.

The Fall Bearing has a full complement of balls. Filling indicates are provided as a rule of crank ring to allow assembly. This type is usually being retained by Johnson Bearings which can be manufactured and assembled.

It has an advantage for certain applications requiring moderate oil and load capacity, but thrust loads because of possible differences between the balls and fitting surfaces. Contact between the balls becomes more of the fall bearing, therefore for low torque in high speed applications.

**CONCAVE**  
The concave bearing is used in high speed applications.

**PROTECTIVE**  
Thrust loads because of possible differences between the balls and fitting surfaces. Contact between the balls becomes more of the fall bearing, therefore for low torque in high speed applications.

**MATERIALS**  
Bristol Ball Bearings require properties that have made it first choice for bearings used in precision instruments, and it has become one of the standard materials for the purpose. It can be ground and finished to a high degree of accuracy.

Ground steel should only be specified when bearings must operate at actual loads of loadability, conditions are often encountered in instruments.

It has a reputation for high load making that indicates that ball is subject to repeat measure if not protected during bearing and use.

Bearing steel should be restricted to applications with deflection requirements in operation in the bearings. All components of the bearing are fabricated from this material. If non-magnetic properties are not required, stainless steel is a better selection.

**LOAD CAPACITY**

A ball-bearing in motion operates at very low speed and efficiency. However, the designer must have sufficient information to assure sufficient retention. The load ratings presented in the New Hampshire Ball Bearings, Inc. catalog tables are based on a standard method for the ASTM after extensive studies and tests. Dynamic load ratings apply to bearings that are rotating. Temperature



Bearing Bearing — Exploded and Assembled Views



Bearing Bearing — Cross-section View

ing installation can be avoided by making use of the G factor shown in our catalog.

Static load ratings apply to bearings at rest. Since this exists in reality for only a short time, static load rating is not usually a design factor. Factors to be used for design, however, and the need for the G factor in its correction, — reference for static load rating to shock loading.

**RADIAL AND AXIAL PLAY**  
Radial play in the displacement of one ring with respect to the other along the diameter of the bearing.

It is important in the successful application of precision bearings and should be specified in orders. A range of .0001" to .0002" accuracy for most applications, but lighter or lower accuracy may be required.

The axial clearance should be .0001" and the total spread from run to run should be less than .001".

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the true quality and geometry of the bearing. Investigations being conducted constantly are producing valuable contributions to the refinement of instrument bearings.



Test Bearing

**INSTRUMENT BEARING**  
An instrument bearing is a ball bearing or roller bearing and is used in the construction of precision instruments.

It is important in the successful application of precision bearings and should be specified in orders. A range of .0001" to .0002" accuracy for most applications, but lighter or lower accuracy may be required.

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Radial play in the displacement of one ring with respect to the other along the diameter of the bearing.



OLYMPUS engine, rated at 16,000 h.p. thrust, is mounted on new Bristol test cell.

**Bristol Builds Dual Test Plant**

Test plant constructed by Bristol Aero Engines Ltd. is designed to handle engines up to 75,000 h.p. thrust, and with minor modifications to the engine mounting stands, engines to 40,000 h.p. thrust.

Currently the plant is being used for ground running of the Bristol Olympus 5 turbojet engine. The engine has developed a 250 h.p. type test run at 14,000 h.p. thrust.

Bristol and the engine that because the most powerful test bed engine in the world. Thrust of 17,100 h.p. has

been observed during running.

To avoid depletion of essential oils, the new plant has been designed as a double unit, with one test cell on either side of a central control room. Three 60,000 g.p.m. tanks, capable of discharging 400 g.p.m. to the plant, provide fuel for engines on test.

None of the jet fuel is wasted in fuel, shaped containers. Two are connected to each cell by a fuel shaped duct.

Jet fuel is delivered vertically at the two centers of each test.



CENTRAL station between dual test cells enables ground running of engines.

PROVIDE *Outstanding*  
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**features you'll like!**

**1 RUBBER TUBING** — by choice of metals called to all types of fluids, including fluorocarbons, oil, water and chemical-resistant fluids, make Darnell Corrosion and Whom highly adapted to rough work.

**2 EASY-PROOFED** — by also giving, Darnell Corrosion gives, zero-free life otherwise, make and corrosion that makes are freely used.

**3 SPRING GUARDS** — Free through spring and springs may also control the ball, thus saving space leaves easy setting of all times.

**4 LUBRICATION** — oil control and wheel bearings are heavily packed with a high quality grease that "vents up" under attack by heat and water. Such fittings are provided for quick grease-gun lubrication.

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## NOW! NEW KAISER ALUMINUM EXTRUSION PLANT SPEEDS SERVICE TO MIDWESTERN INDUSTRIES



Kaiser Aluminum's new, modern extrusion plant at Detroit, Illinois now makes possible even faster service to users in midwestern industrial centers.

Strategically located in the heart of America's industrial complex, the Detroit plant's expanded production facilities assure you of an abundant, convenient supply of high quality aluminum extrusions.

Production facilities include five extrusion presses—two 550-ton presses, one 1250-ton press, one 2100-ton press and a 3000-ton press now being installed. The plant can supply 18,000,000 pounds of quality extruded shapes and tubing a year.

Modern consult, billet casting and the making facilities, plus a 100-ton stretchers, make Kaiser Aluminum's Detroit plant one of the most complete extrusion plants in the country.

### THREE KAISER ALUMINUM EXTRUSION PLANTS SERVE YOU

With the new plant at Detroit, three Kaiser Aluminum extrusion plants are now in operation to meet your increased demands.

At Hialeah, Maryland, Kaiser Aluminum operates two other plants, one with an annual capacity of 40,000,000 pounds, the second with an 18,000,000 pound annual capacity.

Two huge 5000-ton heavy presses in the second Hialeah facility produce hollow shapes up to 17 inches in maximum cross-sectional dimensions, and fast service up to 24 inches wide, 55 feet in length.

These three plants place at your disposal one of the largest, most versatile extrusion operations in the nation. Whether your requirements are military or commercial, Kaiser Aluminum is geared to deliver the highest quality extruded products in the shortest possible time.

For immediate attention in any extrusion request, contact the Kaiser Aluminum sales office listed in your classified telephone directory, Kaiser Aluminum & Chemical Sales, Inc., General Sales Office, Pullmanville Road, Chicago 11, Illinois, Executive Office, Kaiser Bldg., Oakland 12, California.

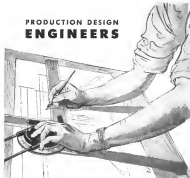


# Kaiser Aluminum

the bright star of metals

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## PRODUCTION DESIGN ENGINEERS



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Skilled production design engineers are urged to inquire at once, enclosing resume to J. L. Mohr, Industrial Relations Manager, Dept. 36.

World's largest producer

of newly invented Power Packages for airplanes



In sunny Chula Vista, California

## German Technique Strengthens Sheet

Basic-Technique that reportedly increases the bending and loading resistance of an sheet material—sheet, plastic, pressed wood or glass—two-fold or more has been developed by Colobot-Turk, GmbH, Hildesheim, West Germany.

Idea behind new technique about a cut or slotted into a surface pattern of elevations and projections so as to give an perforated area of inertia. Any cross-section through the material presents a symmetrical stress plane.

Having about 10 times the bending modulus of flat sheet, according to tests on steel specimens at Statistische Materialprüfanstalt (the government materials testing institute) in Darmstadt, the Colobot sheet would have particular uses for any desired bending strength.

It is claimed that the new technique also increases ductility, making the material 50 to 100% more resistant to rupture.

Lancet negotiations are said to be under way with several German steel and plastic firms and similar talks have been initiated with U.S. companies. So far, trials have been run on strong conventional mild steel equipped with one final stage roll having the cup-shaped elevation pattern.

Two or more sheets can be joined into a single panel, which especially increases bending and loading strength more than 10 times that of similar weight flat-sheet structure. Sheets are joined at meeting projections, i.e., a depression of one sheet fits into a depression of the another sheet, thus forming a double sheet construction. The double sheet construction dampens vibration and sound, it is claimed, and handles efficiently. The failure resistance between the two sheets can be fitted with optional.

The sheets are adaptable to conventional shaping methods. The cup-shaped depressions, when separate sliding surfaces are joined together, can be made to overlap and interlock, thus reducing the number of required fittings.

Applicable possible, according to Colobot-Turk, include construction of flutter-free aircraft wing and tail assemblies.

## Harvard Center Will Study Speed, Altitude Responses

A Harvard-Guggenheim Center for Airborne Health and Safety will be established at Harvard University's School of Public Health in Boston. New center will study responses of human body to extreme speeds, altitudes, temperatures and time spent in flight and on the ground.

## Navy Develops Trainer For Weapons Loading

New type of training aid—Weapons Loading Trainer—has been developed by the Navy for its North American A12 twin engine attack bomber. Training manuals with the new device have been so successful that the Navy plans to develop a similar trainer for its Douglas A1D, single engine bomber.

The current trainer consists of a simplified A12 cockpit and needed operational loading and unloading. Latter includes a bomb bay section complete with suspension rails and a weapon loading operation. The cockpit contains all the instrument controls and power switches and controls used in the actual aircraft.

Trainer simulates the aircraft riding and for pre-flight check, loading actual or simulated weapons, and post-flight check. It can handle all weapons compatible with the A12.

The device, which includes a multi-function capability, is mounted on landing gear to make it both mobile and mobile. It was designed for use as a carrier, on hangars or on the flight line.

The weapon loading trainer was developed under the supervision of Training Division Captain's Hospital Office and was developed by Christened and Roper, both NAS, Norfolk.

## Navy Will Try Fueling Ship by Probe-Drogue

Probe and drogue refueling, long standard operating procedure in the Air Force and Naval Aviation, will be tried by the Navy on a ship-to-ship basis. The operation, very similar to a flight refueling, will involve engaging a nozzle connected to a hose from the tanker ship into the front of a coupling on the receiver ship. The two units will lock together automatically.

Flight Refueling, Inc., has been awarded a contract by the Navy Department for the design and manufacture of the ship-to-ship assemblies.

## Canadair Receives \$2 Million Contract

Macdonald-Canadair Ltd. has received a \$2,005,830 contract for aircraft flight control equipment from the Canadian Defense Production Department, Ottawa. Curtiss-Wright of Canada Ltd., Montreal, at the same time was awarded a contract for aircraft engine components to \$1,411,536 and Bristol Aircraft (Windsor) Ltd., Windsor, received a contract for repair and overhaul of aircraft totaling \$1,739,880.



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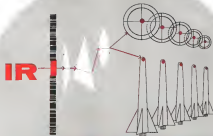


Write: Director of Technical and Engineering Personnel, Aerojet-General Corp., 3801 Wilshire Blvd., Los Angeles 40, California 90010.



### Pre-Loaded Bins Tested

Fast loading of Elctra passenger baggage may result from use of pre-loaded bins made test with marking of the baggage. Lockheed Aircraft Corp. and American Airlines workers move a Elctra bin by dolly to the baggage (above left). Electronically powered, continuous load is converted to the baggage, which is raised by push button action to compartment level (above right). Bin then rolls onto tracks inside the passenger (below). System is designed to load or unload complete set of bins in four minutes. Baggage goes into the bins at ticket counters. Customers are 30 in. wide, 77 in. long and 24 in. deep, weigh 13 lb. empty. American reports the system to help achieve a 30-to-12 minute ground time at intermediate stops for all Elctra.



## INFRA-RED

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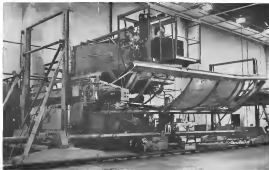
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JUST OF NINE Federal spotwelding machines and automatic positioning tables is installed at Ryan for KC-135 and T-37 program.

## Ryan Spotwelds KC-135 Fuselage Lobes

San Diego, Calif.—Ryan Aeronautical Co. is carrying out the first operations of large double-contoured aircraft panels under automatic positioning and welding control as part of its subcontract for air fuselage sections of Boeing KC-135 tankers and T-37 jet transporters.

Totalling 80 ft. in length, the two craps without support the larger structure over subcontracted in the aircraft industry.

Nine Federal spotwelding machines, built to order at \$10,000 each, will be used when the program reaches full operation.

They are fed the aluminum sheets by means of positioning tables, which in one dwarf the 13-ft. high spotwelding machines.

### Specified by Boeing

Early in the KC-135 program, Boeing specified spotwelding in preference to riveting of skin assemblies to save time and assure a smooth, seamless surface with less drag and weight. Originally the plan was to spotweld only the non-pressurized non-double-contoured single contour skins. But after Ryan received the contract as sole supplier of the air fuselage sections, Boeing asked Ryan to

develop a technique of welding double contour skin assemblies.

In the beginning, Ryan built an experimental handling device to carry the sections through the welding machines. This employed a jacking lifting method, combined with hand position.

Four jacks were mounted on an overhead set of rails and attached to the welding frame in hold it in position. The frame, holding the skins, was manually moved back and forth welding position to the next station process.

This was not a solution but a temporarily crude stopgap while the long range production equipment was being developed by Ryan and General Electric, Inc. of Buffalo, N. Y.

General Electric, which has contributed an electrically-operated positioner for moving, set out to build the first electrically-operated positioning tables for welding machines in the aircraft industry. The company had built tables for electric cranes of wing structures, using low directional movement and cam mechanisms for height and level control. However, the distinct configuration of the KC-135

skins required a new system of controlling to achieve accurate motion in electrically-controlled while guiding panels through the electrodes of the welding machines.

That of the Federal specification has been awarded. The weight more than 50,000 lb. and at the throat position 71x14 in. Three-phase input 250 kw. transformer supplies 100,000 amp. Cyclic free welding of two thicknesses at 901 in. aluminum sheet can be accomplished with a impulse electrode.

### Black Box

One of the major centers of the positioning tables is the sensor-head, a black box with four reflex mirror lenses to control the level positioning of the skin as it comes into contact with the electrode, on which the sensor-head is mounted. Two of the lenses govern vertical motion, one controlling the right elevator and the other the left elevator at the table. On each end of the carriage there is an elevator utilizing screwjacks for lift and descent.

On the carriage itself is a tilting mechanism which raises and lowers a bronze armature. This mechanism is the driven in and out of the throat of the



LOWER LOBES of double-contoured air fuselage sections for KC-135 are built by Ryan under subcontract. Ryan also builds upper lobes.

welder by a transverse drive consisting of a horizontal screwjack mounted on the elevator carriage.

The other two screw-jacks effect lifting motion by operating a tilting mechanism consisting of bevel drive spiders on each station. These spiders rotate the frame and the welding frame in which the skin is mounted.

The face end carriage is automatically controlled by a longitudinal drive rack used for longitudinal positioning of spotwelds. Transverse positioning of spotwelds is controlled by a transverse drive mechanism.

To eliminate scratching of skins during movement, the panel is automatically raised if it is by electronic control of the moving cart. This levels the skin assembly 1 in. above the electrode. Upon command to weld, the skin is automatically lowered to contact with lower electrode, thus insuring any rubbing action.

### Command Units

A pendant is provided for control of the carriage in manual, automatic spacing, and tape command operations.

Manual controls are used for location

of the first spreader, for loading and unloading apparatus, and other controls requiring individual movement by the operator.

Welding commands are manually controlled by the tape command unit, providing complete positioning in all directions, with automatic interval between positioner and welder. The movement is automatically in the controls across a closed loop.

- Welding repetitive welds of constant spacing, such as stiffeners on the skins, etc.

- Assistance in setting the tape for tape



INTERIOR OF KC-135 air fuselage half tube (left) shows stringers and bulkheads spotwelded to double-contoured skin sections. Boeing's drive for automatically skin surface on outer skin of the sections (right) led to development of technique. Spotwelds also save weight.





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Since early in 1951 Beech Aircraft Corporation has been building wings for Lockheed's famous F-35 jet fighter. To date, more than 5,000 sets of F-35 wings have been produced along with hundreds of additional wings for Lockheed's F94C "Starfire" and T2V-1 "Seasee." As further evidence of this continuingly successful subcontract relationship, Beechcraft is now producing the aft fuselage section of Lockheed's new F-104 "Stallfighter," the world's fastest fighter airplane.

You'll also find other major components and famous names on Beechcraft's subcontract production lists . . . canopies and windshields for Convair's F-102 delta wing fighter . . . fuel tanks for Republic's F-104F delta-wing bomber . . . and major sub-assemblies for McDonnell's F-101 supersonic fighter. We're proud of the trust and confidence these outstanding companies have placed in Beech craftsmanship.

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## Beechcraft

BEECH AIRCRAFT CORPORATION, WICHITA, KANSAS, U. S. A.



FOR SPOTWELDING single contoured sheet metal automatic control (right). Ryan uses new steady spinning machines with special positioning control. Operator has precise in panel set off through divider. Single operator can set the spinning machine (bottom) and watch both sides of the panel through a television monitoring screen.



continued operations, including spotwelds of varying diameters.

To follow the curvature of the skin, a taper head is mounted adjacent to the upper electrode of the welder. It profiles against the edge of doublets and cushions to provide uniform edge deformation spacing. This operation permits two damaged sub-assemblies being automatically controlled by the trim. The other, by tape removal, gives predetermined spot spacing per drawing.

The punch hole tape utilizes an air command channel, providing door board and spacing control. Two different double contour skin assemblies are spotwelded onto with their own tape, which is in direct linkage to the

carriage through a Sefcon positioner.

For the single contour skin, Ryan first built a manually-operated positioner consisting of a flat table designed originally for subspotwelding and providing longitudinal index spacing. For spotwelding, a manual spacer was built for the table. This is controlled by a spacing bar attached to the side of the table, a spring-loaded ball fits into a notch in the spacing bar and the indexing is performed notch to notch by hand.

Ryan now has two such tables in straight line spotwelding by Federal aircraft, of lesser dimensions than the double contour machines.

In addition, two General Electric panel holders have been installed to

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single-center drive. These rollers both longitudinally and transversely with a combination of electrical and hydraulic controls. One table operates with a heavy welder that has an exceptionally deep throat for its type—78 in. The other functions with a Federal welder with throat dimensions of 64 in.

These single-center positioning tables incorporate a cascading system, whereby the count is a predetermined number of 1/2 in. increments, the space between the spacers being multiples of three increments.

A photoelectric cell counts light spaces. When the predetermined number of light spaces has passed through the cascading relay, the movement is stopped, automatically firing the welder. A conventional switching system is used for longitudinal, transverse movement.

On the flat positioners for single-center drive, a television camera is placed beneath the table in an inspection aid to determine whether the spot-weld is maintaining required quality. The camera is in front of the operator. On double-center flat positioners, television cameras can be used to assist the operator in controlling dimensional movement.

Handling of the aluminum plates and components of the size discussed in the KC 135 and 747 project is a critical matter. The primary problem is



**EARLY STAN** experimental work with sophisticated welding and this machine and table. Operator lay prone over the equipment.

maintaining the surface cleanliness necessary to ensure the welding strength and quality required to meet structural and appearance specifications. Also critical is the time limit between drying and welding. Welding must be performed within 24 hr after drying to some uniform dimensions and electrical resistance for spotwelding current.

The movement of the parts aggravates the handling problem. Stems

must be protected from fingerprints, oil, dirt, etc. White gloves, special handling clothes, coverings for parts while awaiting welding, and clear toe trol through gateways are among techniques utilized.

Approximately 77,800 parts have so far been produced, and the backlog of components together in the backlog

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But even my intent is a consequence of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a task, because, I think, it's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER WAY TO FIND "CONSUMER  
MEAT" another example: some articles which  
complement the editorial content of this maga-  
zine — the advertising pages. It's been said that in  
a business publication, the editorial pages sell  
"how they do it" — "they" being all the  
industry's best line of innovation and impor-  
tance. The advertising pages sell "with what." Each page holds an industrial exhibition for  
you — giving a ready panorama of up-to-  
date tools, materials, equipment.

NOTE: A "read" is not your pattern. Re-read or "skim" regularly and carefully to the printed/learned information he gives.



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continuous temperatures exceeding 10,000K is being conducted by General Research Laboratory, Santa Ana, Calif. Aimed at determining what occurs in a gas flow with high energy content, the work is being performed under contract with AFOSR. This experimental research is deemed necessary to discover what are the fluid dynamic laws governing the flow of partially ionized gas.

Depending on experimental results and theoretical interpretation, the use of the plasma may be related to propulsion for space travel by bridging the gap between the chemical rocket and the pure ion propulsion system, General M. Gorman, president of the Laboratory, and of G. M. Gorman & Co., Inc., told American Women.

Immersible pocketed applications of the standard gas cylinder is an economical, high-temperature, high-velocity, low-density seal tested for swabbing, recovery conditions and forcing depths and techniques associated with the recovery process. Such a seal tested in a new being marketed at the laboratory. With a simple manual gas jet, temperatures may be obtained which are at least three times reached with the best seals for use. Givens said. This opens the door to materials research with temperatures not obtainable in other means.

Using various gas mixtures and energy concentrations, power as high as 50 kw/sq. cm of nozzle area has been obtained.

Associated with Gosselin is the research activity of Dr. Pol Demers, California Institute of Technology, Prof. Louis Boffetta, well-known physicist, and Ed Gen. Lawrence C. Craig, (left) a director of the company.

General Electric Co. Missile and Ordnance Systems Departments in Philadelphia is now operating a water shielded electron arc for producing a high temperature ionized plasma jet in an evacuated tunnel for simulating ICBM nose cone re-entry conditions. Controlled temperatures in the tunnel have been achieved as high as 25,000°F. General Electric is working with the University of Chicago's Midway Laboratory on this project.

Evidence of the relative merits of one prosthesis system over another will require consideration of many factors, some still unknown, according to George P. Sarnoff, chief, Prosthetic Design Section, North American Aviation, Inc. For this reason it is not possible to make a general statement as to the optimum prosthesis for space travel. The vehicle probably will be a multi-stage ship and must cover two or more types of prosthesis, each used for a specific portion of the flight. A relative evaluation of the optimum prosthesis, he indicated, will require evaluation of mission.

### Ion Power Contract

In his introductory remarks at the opening of the symposium, Brig Gen H. F. Gregory, commander, Air Force Office of Scientific Research, said:

"I am delighted that such cooperation in Canada are working on the proposed plan; that Martin's RIAS division is working on actually new fields of science, and that Fairchild has established a two-week thinking workshop group."

USAF previously had awarded that two small study contracts for such a system had been let, but did not award the company (JAN File 28, p. 37).

Analysis of a hypothetical descent of around 5-ft. sponsored with articles from a popular outlet about 500 words, was presented by Alfred A. Eggers, Jr., Ames Laboratory research scientist. National Advisory Committee for Aeronautics. It was concluded that a citizen using Air Force mail "ought to be able to do it."

The sphere would weigh 630 lb and could mount four or six alt gimbals to keep the body axis aligned with its motion. It would decelerate from the 100-m/s height down to a 50-m/s altitude in about three revolutions of the path. The orbit could be maintained circular by use of a solar motor to steer the vehicle in a direction opposite to its direction of motion.

At about 30 ms, the schale would begin to drag significant, as the atmosphere, and begin to lift. Occupant of the sphere would have to be protected from this heat, which would be about 1,000 Rankine at approximately 40 ms. Inside. There is a good chance of strong lateral boundary flow here (see later) rates are constant.

By the time 55,000 ft. was reached, the speed would be reduced to 400 ip, and a parachute could be deployed to bring the sphere's descent to the ground.

Possibilities of using aerodynamics  
it to control aerodynamic loads and  
not transfer to the vehicle seat out-

ned by Prof. Antonio Fern, Polytechnic Institute of Brooklyn. His proposal concerned coordinating the country clubs by using lift and drag to keep it at high altitude where air currents, as low and, therefore, aerodynamic bearing.

**Analysis of the relative equilibrium**  
configurations of an earth satellite sphere  
penetrating through the atmosphere was  
studied by Fred R. Riddell, senior re-  
search engineer, Aeronautics Research Lab-  
oratory. It was pointed out that, using  
proper design parameters, the Vanguard  
satellite might survive re-entry intact.  
Two schemes were proposed for re-



*How to make the most  
of your engineering career*  
see pp. 4-5/20-21

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engineers are free to do  
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Illustration: Edward M. J. Rogers. Photo by Richard Ross

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Fig. 1

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country destinations at high altitude by using a light high drag body and getting rid of fuel spent by addition or by deceleration at lower altitude and making up lost with a tank.

Possible serious consequences of turbulent boundary layer flow over an entry vehicle, since turbulent layer heat transfer rates can exceed laminar rates by a factor of about 10 to entry speeds, was noted by E. Van Driest, chief scientist, Missile Development Division, North American Aviation, Inc. The first results of his experiments using liquid nitrogen-cooled cones in a super sonic wind tunnel, and showed that dissuading the surface temperature or cooling the cone defined most of turbulent flow significantly. Van Driest also noted that severity of the boundary layer to surface roughness appeared decreased with increasing Mach number.

A better appraisal of the cone's re-heated to mean requires elaborate experiments with artificial wrinkles to study the sub-atmospheric interaction of the lower component and the heat of heat transfer to it according to (Herman J. Schaefer, research physicist, Naval School of Aviation Medicine, Dayton, Ohio) because by the Air Force of its biological before experiments, which it may have been done in laboratory to some aspect work, is inevitable, Schaefer declared. He hoped that an influence to cause an heated is only a temporary effect.

### Concise Key Exposure

Evidence, even that cellular destruction results from exposure to primary cosmic rays, it was pointed out. Fluorescence spectra of changes to cause (larger tail and head) as a result of exposure to primary cosmic rays at 90,000 ft.

Schaefer indicated that if a "living population" were exposed to the dosage of 120,000 ft altitude for 3,600 hr. per day, the number of genetic defects would be doubled, as a result of exposure to cosmic radiation dosage. The second first flew the very slow, a very apt indicates that this body is one of the primary sources of cosmic rays. Then there produced a 35-fold increase in cosmic ray particles, it was pointed out.

A study exercise with three missions including a flight to an altitude of 200 mi., instant altitude flight for 200 hrs. around the earth and a flight around the moon, was suggested by Col. Paul A. Casper, special assistant to Commander for Modern and Aerospace Research, AFOSR. After discussions and experiments had supplied a basis of reference for each of the missions, including duration, crewing, weight allowances, etc., working groups of experts could be formed in aviation.



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medicine, physiology, psychology, law, arms engineering, etc., to establish requirements, available knowledge and discover gaps.

Factors listed by Campbell for consideration included oxygen, food, food, and so conditioning requirements, removal of waste products, natural metabolic rates, use of drugs, sleep metabolic rates low and could not interfere with efficiency, even night activities before flight, terms fitting with a sense of body fit (phases).

These aspects of records into the atmosphere are of particular interest to Holloman AFB's Aerospace Field Laboratory, according to Mr. David C. Hanson, USAF/AFM, chief of the laboratory's space branch. These are:

- Safe recovery of recorded data from a non-retrievable KCM or satellite carrying immediate experiments
- Human factors aspects of re-entry into atmosphere in terms of heat, acceleration, and performance capability
- Valid escape concepts beyond the atmosphere and at orbital velocities

A first step toward experienced in verification of these problems is being taken by dropping test objects from balloons at 90,000 ft to 120,000 ft. Details of a vacuum chamber work an experimental capability of 200 in altitude were revealed by Richard Rothe, Research Dept. chief, Litch Industries. According to Rothe's in Houston, the altitude simulated in low pressure chamber in operation now is 500,000 ft.

## Pressure Chamber

Initial series of the chamber, measuring 5 ft. in diameter and 15 ft. long is scheduled for completion this spring. Built under contract with AFOSR, the chamber is proposed for immediate application in research and testing with various tanks. However, space verification capabilities of the unit will bring its adoption for most work more as well as represent. The chamber is also proposed to an air lock for a large vacuum chamber which will measure 15 ft. in diameter and 35 ft. long.

Key consideration in the operation of the chamber will be protection of the man in the event of rupture at his specially developed pressure suit or facemask. With such failure, he would receive protection for only about 5 sec, and would suffer no air physical injury, perhaps death in 90 sec. Emergency features will allow the chamber pressure to be raised to the equivalent of 35,000 ft. altitude in one second.

Merrett said in space vehicles was discussed by Dr. Fred L. McGehee, director of Smithsonian Astrophysical Observatory and astronomy professor at Harvard. It has been decided that there are a greater number of reviews

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## MEN and the MOON

During the latter years he has been working in the guided missile field. (Caption doesn't make sense) since he covered everything from propulsion design to flight test analysis, with emphasis on the dynamical problems of earth satellites and long range inter atmospheric missiles.

At Systems Laboratories Corporation, this experience is being used in meeting today's top-priority assignments in missile and guided missiles. And he has recently been actually engaged right now in the research and development of orbital-mechanics space navigation. The studies he is making today may get man to the moon and back within the next fifteen years.

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To SLC's president,  
Dr. John L. Renner

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AVIATION WEEK, March 4, 1957

# CAREERS OPEN

...for engineers looking  
a step beyond a "job"

Mechanical, hydraulic, and electrical engineers are needed now to augment a small, new, but rapidly expanding group of mobile ground handling equipment designers at Fruehauf Trailer Company.

This is a rare opportunity to begin early and be in on the ground floor of a vigorous growth program, with a manufacturing established since 1914 as the world's largest builder of truck-trailers.

There is a future and a career—not just a job—open to you if you are qualified.

FRUEHAUF TRAILER COMPANY • MISSILE PRODUCTS DIVISION



Send particulars to A. E. Williams, Executive Vice President, Engineering, Fruehauf Trailer Company, Detroit 22, Michigan, or in California to J. A. Kertson, Manager, Missile Products Division, Fruehauf Trailer Company, 6127 S. Boyle, Los Angeles 38.

## YOUR ORGANIZATION

is it complete?

Are you expanding it?

Making Employment?

Naturally, you are anxious to secure the most suitable man or men available. You want men with the special training that will make them an asset to your organization. You can contact such men through an advertisement in the Employment Opportunities Section of AVIATION WEEK.

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## TEST ENGINEERS

WILL YOU REACH  
YOUR MAXIMUM POTENTIAL?

No matter what your ability, you MUST HAVE the job opportunity and the BEST of TOOLS and FACILITIES to develop your talents to the fullest.

Investigate the Engineering group at AC for its Advanced Development Programs in Atomic Ordnance and Aircraft Test Control Systems.

### OUR ENVIRONMENTAL LABORATORY

is one of the most complete laboratories in the country and we are in the process of a Major Expansion Program. 215,000 square feet plant, being added to existing laboratory.

Our men enjoy working with the latest of our equipment and facilities and with the top men in the field.

We are currently engaged in the following types of Test Activities:

- VIBRATION TESTING
- COMPLEX WAVE ANALYSES
- LOW TEMPERATURE—ALTITUDE
- HIGH TEMPERATURE
- RELIABILITY EVALUATION
- INSTRUMENTATION



Mr. Carl E. Gordon, Supervisor of Technical Employment  
THE ELECTRONICS DIVISION

GENERAL MOTORS Corporation  
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The Jet Propulsion Laboratory is a leading research and development center located at Pasadena (a suburb) of the San Gabriel mountains. Creating an 8-acre area and employing 10,000 people, it is often the most renowned area.

The Laboratory is staffed by the California Institute of Technology and develops many projects in basic research under contract with the U.S. Government.

Opportunities exist in civil and structural engineering, U.S. military and U.S. business and industry.

The latest techniques in guidance, airframe design and rocket propulsion are being applied to the development of this rugged weapon which is capable of operating in any area.

The Jet Propulsion Laboratory, designer of this new engine, has the same prime technical responsibility to provide the development of the complete Ramjet system.

This field, coupled with ideal facilities and working conditions at JPL, is a prime attraction for scientists and engineers of unusual ability because of their close interaction with such vital programs. At the same time, other varied and interesting activities in weapon development are providing new challenges and positions for qualified people.

A DIVISION OF CALIFORNIA INSTITUTE OF TECHNOLOGY  
PASADENA, CALIFORNIA

## AVIATION WEEK MARCH 4, 1957

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#### *Appendix 4: Presidents*

The Johns Hopkins University  
Applied Physics Laboratory

## ANNOUNCES

... offering openings in our guided music research and development staff for men who wish to identify themselves with an organization whose prime purpose is social reform.

Because the Applied Physics Laboratory (APL) exists to make rapid strides in science and technology, staff members require and receive freedom to inquire, to experiment, to pursue original paths of thought. Such freedom is responsible for findings that frequently make off a calm reaction of curiosity throughout the organization. As a staff member of APL you will be encouraged to determine your own goals and to set your own working schedule. You will also cooperate with leaders in many fields, all bent on solving problems of exceptional scope and complexity.

Expenditures between Ridgeville, Md., and Washington, D. C., on new laboratory allows staff members to easily subscribe or when being used for rich content, education and research facilities offered by both cities.

**KESIBAC®** hydrophobic vinyl based flexible elastomers, internal reinforcement layer upon insulation; short-term phytotoxicity evaluation.

SEND NOW FOR OUR NEW 32 PAGE PUBLICATION DESCRIBING IN DETAIL THE SCOPE OF THE LABORATORY'S PROGRAM AND THE UNIQUE ENVIRONMENT IN WHICH STAFF MEMBERS WORK AND LIVE.

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*Professorial Staff Appointment*  
**The Johns Hopkins University**  
**APPLIED PHYSICS LABORATORY**  
3442 George Brown  
Silver Spring, Maryland







## NEW "FLYING WORKHORSE" JOINS USAF

### First Delivery of Lockheed C-130 Hercules with Allison Prop-Jet Power

It can take aboard a 5,000-gallon fuel tank and tractor.

It can carry 60 to 90 fully equipped combat troops — and land on small, hastily prepared fields close to combat areas.

It can airlift up to 20 tons of cargo swiftly and efficiently — and make parachute drops for on-the-spot aerial delivery.

It's the great new "workhorse" of the Air Force — Lockheed's versatile C-130 Hercules — now being delivered to the Tactical Air Command's 18th Air Force at Ardmore Air Force Base, Oklahoma.

Powered by four 3,750-horsepower Allison T56 Prop-Jet engines driving three-bladed AeroProducts Turbo-Propellers, the C-130 attains speeds of over 350 miles per hour — more than

100 miles per hour faster than other tactical transports. *And it does this at less than half the ton-mile cost of its nearest competitor.*

A commercial version of the T56 — Allison's Model 501 Turbo-Prop engine powering the new Lockheed Electra — will bring jet-age speed and luxury to commercial service, with new smoothness and quiet on flights now

serving 98% of the nation's commercial passenger traffic. 128 of these new luxury airliners have been ordered by six major airlines.

This great new concept in aircraft power reflects Allison's unmatched experience in the design and development of aircraft turbine engines and turbo-propellers.

ALLISON DIVISION OF GENERAL MOTORS — Indianapolis, Indiana



VERSATILE POWER FOR JET-AGE FLIGHT